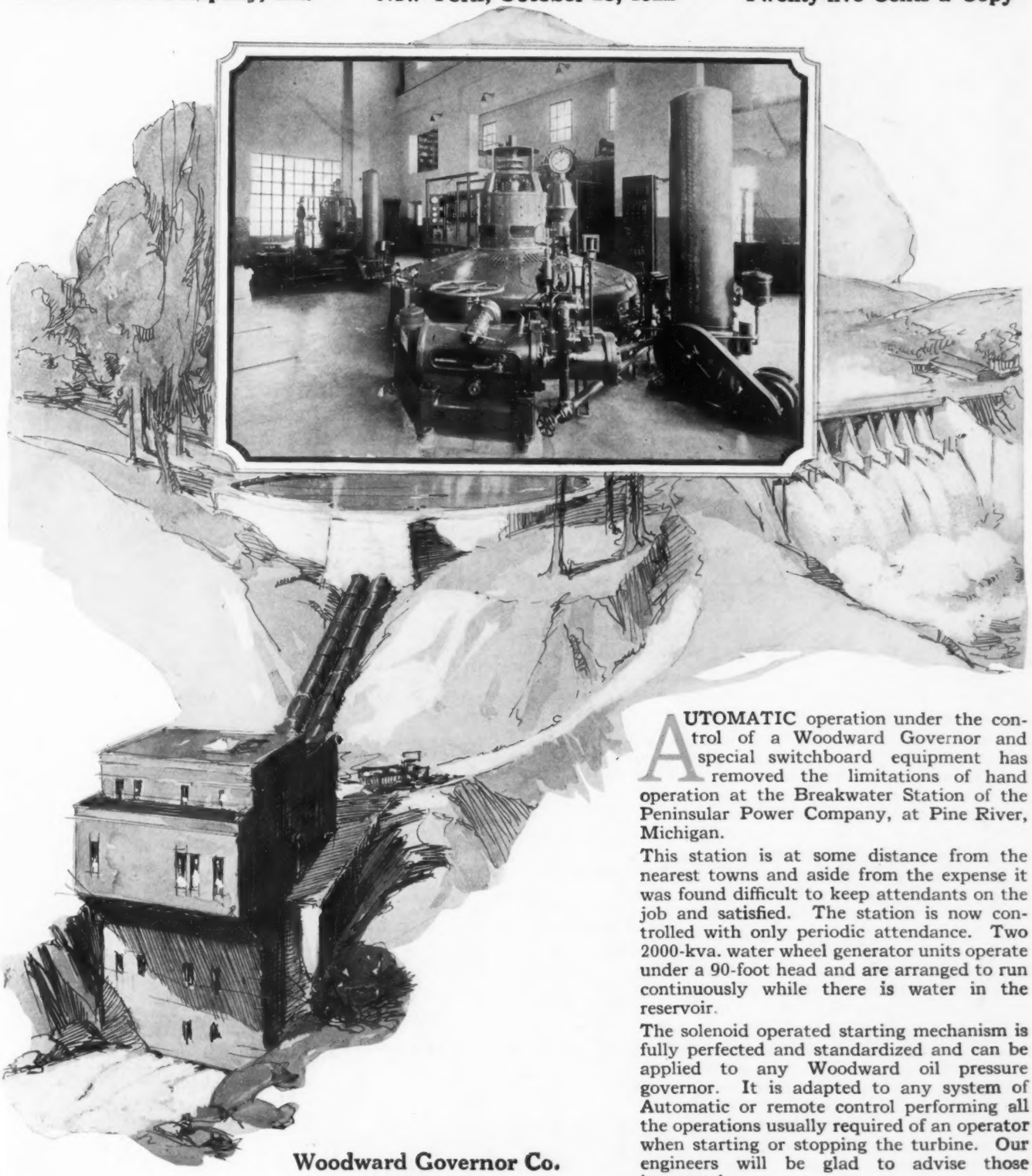
Engineering Library

Electrical World

McGraw-Hill Company, Inc. New York, October 28, 1922 Twenty-five Cents a Copy



Woodward Governor Co.
Rockford, Ill.

AUTOMATIC operation under the control of a Woodward Governor and special switchboard equipment has removed the limitations of hand operation at the Breakwater Station of the Peninsular Power Company, at Pine River, Michigan.

This station is at some distance from the nearest towns and aside from the expense it was found difficult to keep attendants on the job and satisfied. The station is now controlled with only periodic attendance. Two 2000-kva. water wheel generator units operate under a 90-foot head and are arranged to run continuously while there is water in the reservoir.

The solenoid operated starting mechanism is fully perfected and standardized and can be applied to any Woodward oil pressure governor. It is adapted to any system of Automatic or remote control performing all the operations usually required of an operator when starting or stopping the turbine. Our engineers will be glad to advise those interested.

The WOODWARD OIL PRESSURE GOVERNOR

SIZE

All instruments are about the size of a small hand camera—or approximately 3½ in. x 5¼ in. x 6½ in.

WEIGHT

Each instrument weighs approximately 3¼ pounds.

PRICE

432 Wattmeter—$50 and up.
433 Voltmeter—$30 and up.
433 Ammeter—$28 and up.

These NEW Instruments Meet a REAL Need

They exactly fill a requirement always felt for alternating current instruments that are small, light and inexpensive, yet entirely practical for all general factory and field tests. Every engineer, power plant and industrial plant will want a set of these instruments because of their convenience and characteristic Weston dependability.

WESTON, JR. A. C. PORTABLE INSTRUMENTS

Light—Compact—Efficient—Inexpensive

All three instruments, together with Weston Model 461 Multi-Range Transformer can easily be carried in a small suit case.

Model 432 Wattmeters are made with double voltage and single current ranges. Shielded against external magnetic fields. Negligible temperature errors. Ranges up to 50 amperes and 300 and 150 volts, self-contained. Model 433 Voltmeters have either single or double range, Ammeters—a single range. Accurate within ½%. Wattmeters or Ammeters when used with Weston Multi-Range Current Transformer Model 461 permit measurements up to 800 amperes. Bakelite cases. Strong carrying handles.

This series is so unique, practical and necessary that you should know all about it at once. Bulletin 2006 describes and illustrates the instruments fully. ***Write for it TO-DAY***

Weston Electrical Instrument Co., 13 Weston Ave., Newark, N. J.

New York, Chicago, Philadelphia, Boston, Cleveland, Detroit, St. Louis, San Francisco, Denver, Cincinnati, Pittsburgh, Richmond, Buffalo, Rochester, Minneapolis, New Orleans, Jacksonville, Seattle, Syracuse

Represented by Northern Electric Co., Ltd., in:

Montreal, Halifax, Quebec, Ottawa, Toronto, Hamilton, London, Windsor, Winnipeg, Regina, Calgary, Edmonton, Vancouver

Represented by A. H. Winter Joyner, Ltd., Montreal (for Power House sales only) and Toronto

Branches in Principal Cities Throughout the World

WESTON

"STANDARD" *The World Over*
ELECTRICAL INSTRUMENTS

An Indicating Instrument for Every Individual Need and Industrial Purpose

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, Jr. Editor — HAROLD V. BOZELL Editor

EARL E. WHITEHORNE Commercial Editor — ALLEN M. PERRY Engineering Editor — L. W. W. MORROW Associate Editor — J. C. MARTIN Western Editor — ROBERT SIBLEY Pacific Coast Editorial Director — H. S. KNOWLTON New England Editor — ROBERT M. DAVIS Statistical Editor

T. P. KINDIG Associate Commercial Editor — H. M. CUNNINGTON Trade and Markets Editor — R. L. SHEPHERD Assistant Engineering Editor — H. C. ANDERSON Assistant Western Editor — PAUL WOOTON Washington Representative — F. C. WELLS Associate News Editor

Volume 80 — New York, Saturday, October 28, 1922 — *Number* 18

"When Public Service Isn't"

A LETTER from "an impatient sufferer" has just been published in *Collier's*. It is a frank, clever, sensible letter of protest telling in amusing good humor of an experience with a public service that doesn't seem eager to serve. It is a pathetic picture of the way it looks to the householder when the process of obtaining electricity is beset and bedeviled by the annoying inconvenience of slow official routine and an apparent total forgetfulness of the comfort and desire of the customer.

The fact that this article has been read by hundreds of thousands makes it a matter for consideration. For one cannot doubt that this picture is painted in true colors.

BRIEFLY—a household had waited long for service. Finally a line was built their way. They secured a contractor to wire the house, who borrowed tools and left litter all over the place. After a wait the power company's men dug a hole in the front yard and covered it with brush. After a wait they set the pole and left the brush. It was a joint pole, and after a wait the telephone people transferred their lines and left the old pole and dirt on the grass, abandoned. After a wait they were cut in, but found that the panelboard was wrong. The power company's man fixed this, but then the kitchen, dining room and barn were dark. They are now waiting for the contractor to come again and seek the cause. Meanwhile they find that they have bought lamps of the wrong size. The letter says:

> "Somewhat irritated—that's how we feel about it all. After forty years of electric light it ought to be possible for one company to plan, finish and test the work and clean up after itself. That would be a solider basis for public good will."

ONE company can't do it all. But one company can and should do what is necessary to insure good service to the householder in all his normal contact with the electrical industry, and to assure good will. And that one company is the central station.

The central station can not, should not do all the wiring—can not, should not sell all the appliances. But the central station can and should so operate its own departments and so guide, inspire and organize the local electrical family that the standards of service will be uniformly high. For the central station is the "daddy" of the local electrical family. They are its progeny. And the central station must hold itself actively responsible for the family's good name.

Whether the new customer gets service from the company promptly or not is merely a matter of organization and policy. Whether or not his house is wired quickly and well again depends on organization and ideals. Do the local contractors habitually do good work and make friends for electric service? The central station cannot rest until the standard reaches this height, for nothing counts unless the customer is thoroughly pleased with electricity and the service.

John Garrett Barry

A sales executive, now vice-president of one of the world's greatest industrial organizations, who has rendered valuable service in the promotion of research and development, especially in the street-railway field.

NO MAN can win a higher tribute from the world he works in than to have it said by all his fellows that he is one who "gets things done." For the foundation of industry is production and the life of industry is progress, and production and progress are achieved on the modern scale only through the work of massed men, inspired and led by executives with the vision to see what should be done and the power and courage to carry through large purposes to full accomplishment. Such a man is John Garrett Barry, in whose honor a distinguished company of men prominent in the electric railway field gathered at an elaborate banquet in New York on Thursday last to celebrate his appointment as a vice-president of the General Electric Company.

Thirty-two years ago, his school education over, Mr. Barry entered the employ of the Thomson-Houston Company as an apprentice in the shops at Lynn, Mass. His advancement from this point up to his present high position has been an even record of consistent service. After his apprenticeship he entered the construction department of the old company, first at Lynn and then at Boston. When the General Electric Company was formed he transferred to the railway department, then one of the two major divisions of the company. These were the pioneer days of the electric railway and there were many problems. Mr. Barry became intensely interested and set himself to help develop the great opportunities ahead for street railway transportation. His tremendous capacity for work, his broad vision, his soundness of judgment, and above all his deep human sympathy and understanding have enabled him to contribute greatly—a conspicuous figure in the evolution of this important branch of the electrical industry.

Mr. Barry was strongly attracted to the business field. His ability to sense the difficulties involved and work out their solution led to his promotion to assistant manager of the department in three years' time. In 1907 he became manager. In 1917 his signal success won him appointment to the position of general sales manager of the company while still retaining the direction of the railway department. And finally last June came the further distinction of his advancement to a vice-presidency. It has been called "the most popular appointment" of recent years.

Throughout this time Mr. Barry has been a mighty influence for the promotion of research and development work that has brought great benefit to the electrical industry. His rare faculty for inspiring men to loyalty, enthusiasm and effort has been a vital force in the upbuilding of his organization. He has rendered valuable aid to the American Electric Railway Association in years of service on the executive and finance committees. He has given generously to public work as a member of the Board of Education of Schenectady and as Fuel Administrator for the Schenectady district during the war.

Mr. Barry was born in Boston in 1868. He is a director of the Schenectady Savings Bank and the Schenectady Trust Company and a member of the Schenectady Board of Trade, the Mohawk Golf Club, the Mohawk Club, the American Institute of Electrical Engineers and the Engineers', Railroad, Bankers' and Lotos clubs of New York.

Editorial Comment

Electrical World, October 28, 1922

Volume 80 Number 18

Getting Joy in the Job

THE president of Columbia University, Dr. Nicholas Murray Butler, made some very interesting observations on thrift and thriftlessness before the American Bankers' Association two weeks ago. Always eloquent and instructive, Dr. Butler on that occasion let fall many pearls of wisdom which our industry especially can appreciate. "We must regard industry," he said, "as a co-operative undertaking between those who work with their heads, those who work with their hands and those who work with their savings, and the sooner we can by thrift make the man who works with his hands also a man who works with his savings the sooner we shall get back to joy in the job." To the truth of this observation our industry can testify. Ours has been the first to invite its workers and its patrons to become its partners on a large scale, and the effect on the individuals and on the community has been wonderful. Let those who still doubt or hesitate ask Britton or Insull or Miller or a number of others what transformation the sale of securities to employees has wrought in their organizations. "Joy in the job," yes! joy and zest and a pride which no mere salary could ever buy.

A Sensible Way to Co-ordinate Effort

CO-ORDINATION of the activities of the engineering committees of the several associations interested in power-plant construction and operation has been undertaken by a committee composed of the chairmen of a number of committees of the American Institute of Electrical Engineers, the National Electric Light Association, the American Electric Railway Association and the Association of Edison Electric Illuminating Companies. The definite movement, the desirability of which had been frequently voiced in the past, started at the instance of President McClellan of the American Institute early this year and represents what is probably the most practical form of co-ordination of effort.

Theoretically, perhaps, with the great specialization of today there ought to be one organization taking care of the problems of electrical equipment and another taking care of those involved in the use of mechanical equipment. Practically the use of the two classes of equipment has become so interwoven in industry that they cannot well be considered separately. Added to this is the growth of a group of problems involving finance, operation and management, either directly or indirectly, that cannot properly be considered except in connection with the technical problems. As a result, in each of the organizations concerned with these problems a body of men has been drawn together by interest in common problems in the form of committees whose activities duplicate to a greater or lesser extent the work done by the similar groups in the other associations. Regardless of the theoretical desirability of some other form of organization, the simple fact is that these organizations exist and have back of them a history of usefulness that prohibits wiping them out by the wave of a hand.

There are other fields in which a similar duplication of effort is taking place, and as time goes on others will develop from activities which now seem unrelated. The simplest way to work out the whole problem is along the lines followed in the case of the power-plant activities. Bring together the men who are interested in related activities so that they may be familiar with each other's work. If this can be done, the question of undesirable duplication of effort will solve itself as most of such duplication is due to ignorance of other activities in the same field.

Steinmetz and State Water-Power Development

BECAUSE a man is a great engineer or inventor it does not follow that he is a great statesman or artist. Rarely is it given a man to excel in more than one calling. Charles P. Steinmetz, for example, is a great engineer. The electrical industry respects and admires his engineering skill and proficiency; in fact, there are few that the electrical engineering fraternity holds so high in its esteem. But every informed engineer knows that Steinmetz is a socialist and that because of his socialistic utterances he was obliged to flee his native land and seek this haven of religious and political freedom. The world admires, even though it may not follow, a man of deep convictions, so long as he is sincere. Of Steinmetz's political sincerity there can be no doubt. The best and most convincing proof is the fact that he has clung to his political beliefs through bitter and relentless persecution. Of such stuff the martyrs and heroes of all ages have been made.

This year Steinmetz is a candidate for state engineer and surveyor on the ballot of the American Labor party, a composite of the Socialist and Farmer-Labor parties of New York. While he is eminently fitted for such a post, it is a foregone conclusion that he will run a bad third, so that his candidacy need not give the electrical industry any concern. What does cause the electric light and power industry grief, however, is to have a man of Steinmetz's standing and reputation publicly state that "as state engineer I shall be able to accomplish something in developing for all the people the abundant natural resources of our state, and more particularly the great water powers which now are running to waste, but which developed could operate all the industries and railroads and bring electric light and power to every home."

In the case of New York no state engineer, not even Steinmetz, could accomplish this without radical changes in the law. The electric light and power industry has

not been remiss in its obligation to develop the water powers of the state whenever and wherever it was economically possible to do so. The stumbling block has been the law and not the industry, and any intimation, even by innuendo, that the industry has been slack does it a wrong. Steinmetz's utterances at this time, however, have a more far-reaching effect than this. At the present time state ownership of water powers is being combated in California, and one can readily imagine with what glee the proponents of state ownership will welcome such an utterance from a man of the high standing in the electrical industry attained by Steinmetz. The general public will not differentiate between Steinmetz the engineer and Steinmetz the politician, and hence unwittingly Steinmetz will bring hurt to his industry. We cannot believe that he knowingly or willingly intends any such thing. He himself has contributed so much toward its upbuilding that he would be one of the last to wish to help to tear it down, and we feel sure that had this phase of the situation entered his consciousness his public statement would have been greatly modified.

Reducing Transformer Core Loss Will Not Decrease Annual Over-All Expense

IT HAS sometimes been pointed out that one of the reasons for the relatively slow development of farm lines has been the expense involved in the all-day losses or core losses on the transformers. There is no question that these losses are a considerable item of expense, and that were it possible to reduce them without unduly increasing the copper loss at the time of full load, some material gain would be obtained. However, in this connection it must not be forgotten that cost of the lost energy per unit is considerably higher at peak-load time than it is during the rest of the day. It has been suggested that the transformer be so built that the core losses will be reduced considerably. It is unquestionably true that such a transformer can be designed. However, it means a larger transformer with larger copper losses, and every increase in size means an increase in first cost.

By studying this subject it will be seen that the core losses per year on our present distribution transformers, even assuming a high cost of energy, will only be from 25 to 50 per cent of the yearly fixed charges on the transformer considering the first cost of the machine, its installation and protection based on a life of from fifteen to twenty-five years. From this it is evident that the increase in first cost for the sake of cutting down the core-loss cost will result generally in an over-all increase in the annual charge on the installation. Our present-day transformer is a highly efficient piece of apparatus, and a further reduction in core loss would possibly result in an undue increase in first cost.

The problem which is before the manufacturer would seem therefore to be to produce a cheaper transformer not by materially changing its characteristics but by devising new means of quantity production which would cut down its first cost. Furthermore, operating companies would do well to study means by which they can lower their cost of handling and installing transformers. Progress along these two lines will tend to facilitate the building and operating of rural lines, which are now rightfully considered a necessity to the further development of our farms.

Further Suggestions on Utility Cost-Analysis Methods

ON ANOTHER page of this issue of the *Electrical World* an article appears which shows in detail the application of the theory of utility cost analysis that was described in its general features in an article in the Oct. 21 issue, page 878. The theory and method of the work the authors of the article outline has been developed as the result of the needs of an Iowa company and is the product of a thorough and exhaustive study that has taken nearly three years to complete. Undoubtedly the first response of many interested in such matters will be that the system is too complicated to become a practical method for any utility to use. Another "reaction" will be on the part of those who generally prefer not to know their costs of doing business, on the theory that detail cost figures will be used as a club to reduce rates. A careful examination of the method and its application does not indicate any more complication, or in fact as much, as that contained in the cost-analysis systems of many factories engaged in quantity production. It does not represent any more difficulties than are involved in the series of motion studies that have been so big a factor in the increase of efficiency in many industries, particularly the automobile industry, which has carried such studies to what a few are inclined to view as an extreme.

Industry has been driven to such methods because competition forbids waste and inefficiency. In the central-station rate situation some of the things that exist would be laughable if they did not contain elements of business tragedy. Public opinion has little tolerance for court and commission proceedings in which several experts can start with the same figures and end up with results that are as far apart as the poles. In central-station operations there are definite figures to start with. These begin with investments in physical property. The total cost of actual operation of the property is a definite figure. On top of this the average consumer of any class makes a demand on plant facilities that is measurable with a fair degree of accuracy. Eliminating, for the time being, all the intangible figures on which there may be logical reasons for wide disagreement, there is no reason why the definite figures cannot be analyzed to show the costs of maintaining the business in so far as these items are concerned. The method described by the authors of the article is a definite attempt to do this as a routine accounting matter. Quantities used are based on definite investment and operating figures obtained from the ordinary accounting figures found in any utility records. The load data on which distribution of costs is based are ascertainable if a serious effort is made to get them. In the method are a few items that are estimated. All of these things considered, it appears probable that the final figures are pretty nearly accurate. At least they are nearer accuracy than any spasmodic attempt at analysis.

Whether the method described will actually do all that its authors believe is a question that cannot be answered now, but the careful study and time put on the development of the scheme entitle it to a thorough study and a real attempt to learn all its merits or demerits. It is, at the very least, a step in the direction in which economic pressure is steadily forcing all business activities—that of a better and more complete knowledge of the cost of doing business.

Meter Maintenance on Power Systems

RADICALLY different in scope is the problem of meter maintenance on a large electric transmission system as compared with that of the ordinary localized central station. In both classes of utilities the work must be well organized and handled with technical precision, but the area of territory involved and the extensive wholesaling of energy characteristic of the transmission company broaden the problem as the engineer usually faces it. On another page H. M. Johnson describes the meter-testing practice of the New England Power Company, operating a great hydro-electric and interconnected steam-plant system at 66,000 volts and covering an area extending from tidewater to the Berkshire Hills. About 1,000 meters are involved, and considering their scattered location an annual maintenance cost of about $15 per meter looks like a remarkably good figure.

We have seen reading and maintenance costs ranging from $7.50 to $12 a meter from central-station companies using tens of thousands of instruments, and it is evidence of excellent planning to attain the New England Power Company's figure with the handicap of distance and relatively small number of units there imposed. Readers of this article will find a surprisingly small force required to perform the work, but with a divisional organization supplemented by a well-appointed centralized laboratory, complete schedules of routine inspection and thoroughly prepared forms and index records much can be done by a few persons. Labor and time-saving devices also play their part.

Significance of the Convention of the Great Lakes Division

SOME idea of the ultimate possibilities of the geographic division organization of the National Electric Light Association can be gained from the recent convention of the Great Lakes Division at French Lick Springs, Ind. While the division covers a territory in which central-station development is greater than in any other single division, and while it is perhaps the only division in which activities are great enough to parallel closely the national organization in all its work, the registration of nearly five hundred delegates was better than even the most hopeful could have expected. The program was excellent and the ideas brought out in the various papers and addresses were helpful, but the greatest benefit was in the personal contact among the delegates and the private discussion of problems that was stimulated by the convention sessions. It is impossible to bring together so large a body of men to listen to a well-rounded program and not send them home with an idea of how the day's work can be done better and more efficiently and a clearer recognition of the fact that the central-station business has passed definitely out of the period when each company can consider its problems as individual and solve them as if they concerned no one else.

More significant even than the large attendance was the fact that many of those there were men who do not expect to get to national conventions. In the sessions of the Great Lakes Division they were brought into contact with some of the most important questions in the field, discussed not only by their neighbors but by men who have taken part in the handling of the same problems in a national way. In short, men who have never attended and for some time to come cannot hope to attend national conventions had an opportunity to see problems from a national viewpoint and learn at first hand the national significance of events at home that have seemed to them to be of local concern only. This is an important function of the geographic division organization.

In spite of the points of criticism that can naturally be found in the development of any movement of this kind, the gathering at French Lick Springs indicated clearly the part the geographic division activities can and will play in bringing home to individuals the national aspect of their problems and the urgent need of meeting these as they arise with the best thought that the entire industry can bring to bear.

The Wise Choice of a Leader

IN SECURING Dr. S. W. Stratton, long chief of the Bureau of Standards, for its president, the Massachusetts Institute of Technology has made a wise and fortunate choice. To head that great institution of learning efficiently requires a leader both of scholarly attainments and of great executive ability and tact. Dr. Stratton's ability as a teacher is remembered with pleasure by many who worked under him, and his successful and efficient administration of the National Bureau of Standards for more than a score of years shows plainly his qualifications for the very big task now looming ahead of him.

The Massachusetts Institute of Technology has possibilities not exceeded by any educational institution in the country, but it has been in various ways handicapped, at times by lack of funds and again by serious overcrowding. Beginning as it did in a small way numerically, governed by a great educational leader and its faculty sitting in committee of the whole, it has encountered more difficulties than usual in adjusting itself to great expansion and the effective co-ordination of widely expanded interests, but it has grown stronger with every year in spite of these casual difficulties. After the death of the lamented Dr. R. C. Maclaurin the institute was administered by a committee of the faculty until Dr. E. F. Nichols assumed the presidency, only to resign from ill health before actively taking office. Then it was fortunate in obtaining the guiding hand of Prof. Elihu Thomson to steady its course through another interim, until a new and fit man could be found to take the full responsibilities of the presidency.

We felicitate Dr. Stratton on his appointment and the institute on having made it. He has ample experience as an educator for the work of the modern college president and still more experience in the strenuous work of organization and administration which lies at his hand. Moreover, he has, in addition to his Western experience, sufficient familiarity with Eastern institutions to realize something of the forces that give them power and permanence; for the strength of the older foundations of the East lies not in their presidents, or trustees, or faculty, or students, but in the great and earnest body of alumni and their friends who jealously guard the interests of their Alma Mater. If we mistake not, the alumni of Technology will find Dr. Stratton ready for cordial co-operation and anxious to keep the institute on the firing line of progress.

Largest Incandescent Lamp in the World

A 30,000-WATT gas-filled incandescent lamp, developing about 60,000 candlepower—the largest lamp of its kind—was shown publicly for the first time at a recent convention of the Illuminating Engineering Society at Swampscott, Mass. This monster lamp was developed and constructed at the National Lamp Works of the General Electric Company, primarily for motion-picture studio use. The bulb is 12 in. in diameter and 18⅜ in. high. The filament, which is designed for 120 volts and 250 amp. (total current), is made of tungsten wire, $\frac{1}{10}$ in. in diameter and 93 in. long, constructed in four coils. The filament support and sealing of lead-in conductors constituted two of the major problems of construction. Some idea of the illumination it will produce is shown by the foreground of C, which was lighted by this lamp alone. Dr. Langmuir and Thomas A. Edison are pictured in A examining the lamp. A comparison of this 30,000-watt lamp with a 10,000-watt and a 25-watt lamp is afforded by B.

A

B

C

Meter Maintenance on Scattered System

Organization of Work in the Extensive Territory Served by the New England Power Company—Field and Laboratory Test Schedules—Labor-Saving Equipment Used

By H. M. JOHNSON
Chief Meter Inspector New England Power Company, Worcester, Mass.

THE extensive area covered by the New England Power Company system and the nature of its business present many problems in meter maintenance peculiar to a system of its type. The business of the system is exclusively wholesaling electrical energy, which means that while the number of customer installations is comparatively small, each meter installation is of the greatest importance and the maximum of meter accuracy is imperative. Metering throughout the system is largely at primary voltages ranging from 66,000 to 13,000. A considerable number of installations are metered at secondary voltages, however, which extends the metering voltage range down to 220. To a large extent self-contained outdoor metering outfits are used for primary metering.

To maintain meters, of which about 1,000 are in service, most efficiently the system has been split up into three divisions segregated with reference to the number of meters in each as well as the area covered. The territory of each division is shown in Fig. 1. Routine testing and inspection of the meters in all the divisions is handled by three metermen, one man being assigned to each division. A fourth meterman handles shop testing and assists, when necessary, in maintaining schedules in all divisions. Headquarters for the West Division are permanently at Shelburne Falls, while for the rest of the system headquarters are at Worcester in the general offices of the company.

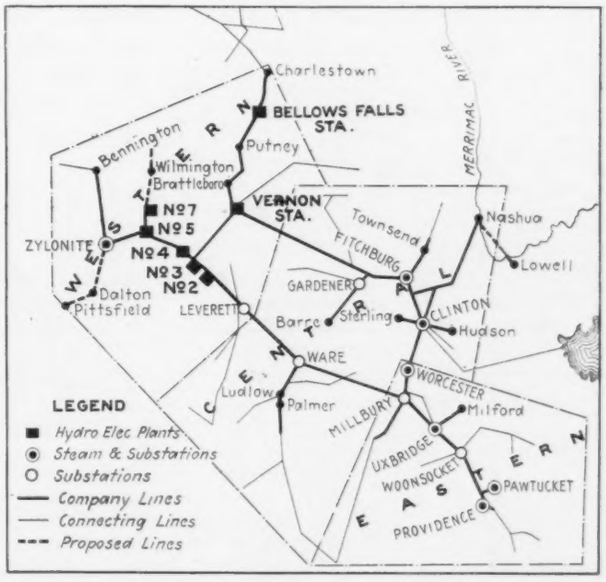


FIG. 1—METER MAINTENANCE IS SECTIONALIZED BY GEOGRAPHIC DIVISIONS

ROUTINE TESTING SCHEDULES BEST

It has been found advisable to use intervals of one, three and six months for routine testing schedules of three classifications of meters. Meters registering over 100,000 kw.-hr. per month are tested on the monthly schedule; all other customer installations are tested at three-month intervals. Station and lighting service meters are tested once in six months. The routine tests, with the exception of those on the monthly schedule, consist of a running-load check followed by a phantom-load check at full and light loads. Adjustments are made during the phantom-load test, and when adjustment has been found necessary a second running load test is made. Accuracy at the lower power factor of the running load must agree very closely with the final phantom-load test, or the meter is scheduled for early replacement by a shop-tested and properly lagged meter. This rather elaborate test covers pretty thoroughly the condition of the meter and is particularly necessary when compensation for instrument transformer errors is being made.

In the case of meters on the one-month schedule, this complete test is gone through only at three-month intervals, the intervening tests consisting only of running load checks plus general inspection. The meter test schedule chart shown in the table gives the general set-up for this work. Meter test results are recorded on cards of the form shown in Fig. 2. Records of tests are entered, as received, on charts laid out as shown in figure, each separate schedule list for each of the three divisions being typed on a separate chart. Each month a list of meters due for test during that month in each of the divisions is drawn off from these charts. These lists are then passed on to the metermen in the form of mimeographed complete divisional lists of meters, with the meters due for test checkmarked. At each test load power factor is determined by comparing separate element registrations and is recorded on the test card. Further, voltage readings between each pair of phases are required. These voltage readings have

METER TEST SCHEDULES

R.L.=Test on normal running load plus inspection. P.L.=Test on phantom load at 10 per cent and 100 per cent of full load.

Meter Classification	Initial	Months Elapsed Since Previous Test: 1	2	3	4	5	6
Customers using more than 100,000 kw.-hr. per month	R.L. +P.L.	R.L.	R.L.	R.L. +P.L.	R.L.	R.L.	R.L. +P.L.
Customers other than above	R.L. +P.L.	..	..	R.L. +P.L.	..	..	R.L. +P.L.
Lighting service and station	R.L. +P.L.	..	..	..	..	..	R.L. +P.L.
Station indicating and graphic	P.L. Calibration	..	..	..	..	..	P.L. Calibration

on several occasions served to discover incorrect potential transformer ratios due to the breakdown of one or more sections of primary windings which would not have otherwise been evident. Meter readers are provided with test lamps and are required to check all potentials each monthly reading date.

Polyphase rotating standards are used in all test work. For phantom-load work these are used with elements in series-parallel. All service meters are rated at 110 volts, 5 amp., and are used in connection with instrument transformers. To facilitate the cutting in of the standard for tests, test blocks of the types illustrated in Fig. 3 A_1 and A_2 are used in all installations. The standard meter connection places a test block on both sides of the meter in the current transformer leads and one in series with either of the potential leads other than common. This set-up permits the cutting in of the standard for running load tests or cutting the meter clear of the instrument transformers, except for the one potential used in phantom-load tests, without disturbing wiring. The test block shown at A_1 in Fig. 3 is the older type of block, of which a great many are in use in connection with both meters and relays. The newer type shown at A_2 was developed to economize space required for mounting. The brass bar across the top is connected at one terminal to the transformer lead. In a slot at right angles to the top bar is a second bar which has a terminal brought through the fiber base at either end, one of the end terminals being connected to the meter. This leaves one terminal on each bar free for connection of test meters. The large brass screw at the center of the block serves as the connecting link between the two bars and is removed after the test meters have been connected.

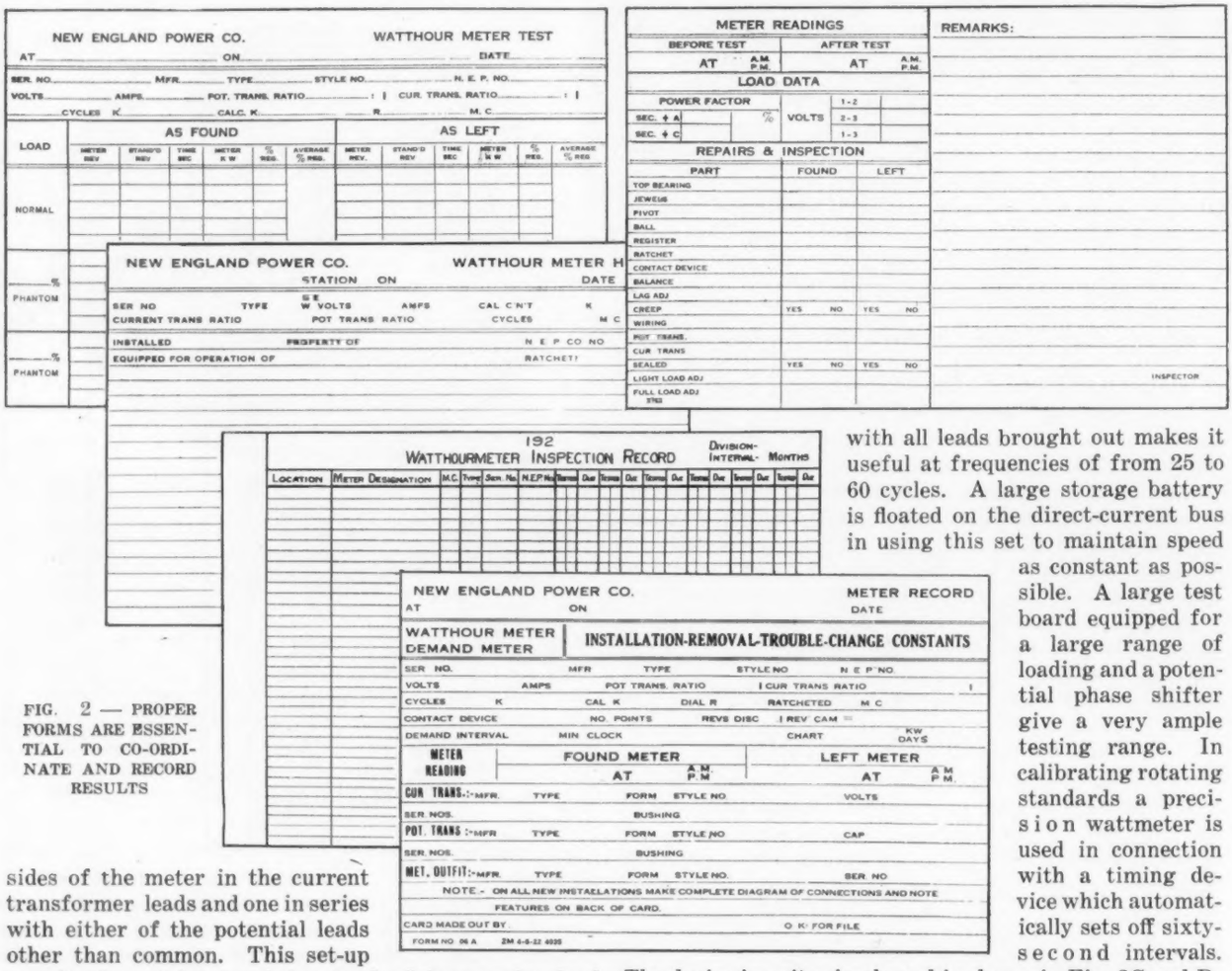


FIG. 2 — PROPER FORMS ARE ESSENTIAL TO CO-ORDINATE AND RECORD RESULTS

CENTRALIZED LABORATORY SERVICE USED

The meter laboratory for the system is at Worcester (Fig. 4). This laboratory is equipped for general calibration of service meters and rotating and indicating standards. Energy for testing is supplied at single-phase from the local distribution system. When a polyphase source is required, a single-phase alternating-current to direct-current motor-generator set is used to supply a variable speed direct-current motor direct, connected to a 3-kw., three-phase, 110-220-volt alternator. Subdivision of the armature winding of this machine with all leads brought out makes it useful at frequencies of from 25 to 60 cycles. A large storage battery is floated on the direct-current bus in using this set to maintain speed as constant as possible. A large test board equipped for a large range of loading and a potential phase shifter give a very ample testing range. In calibrating rotating standards a precision wattmeter is used in connection with a timing device which automatically sets off sixty-second intervals. The device is quite simple and is shown in Fig. 3C and D. The time element is derived from a weight-driven, eighty-beat Seth Thomas clock equipped with a one-point cam on its escapement-wheel shaft, the cam serving to close a pair of light brushes once for each revolution of the escapement shaft, or once a minute. These brushes control a telegraph-relay circuit, which in turn controls the actuating magnet of the timing device. This magnet, through the lever and ratchet mechanism of an old graphic type demand meter, revolves in steps the old-type printometer commutator. The fixed brush is alternately in contact with a conducting and insulating segment of this commutator as impulses are given to it by the clock. The rotating standard potential circuit is completed and broken through the

brushes and the meter commutator. This device has served its purpose very well, and much more accurate results are possible by its use than were possible with the stopwatch. Rotating standards are normally checked for calibration once a month unless in a shorter period reason is given to suspect inaccuracy. Since standards must be transported over considerable distances each day, both in automobiles and trains, considerable care has to be exercised in handling them that accuracy may not be lost. In connection with automobile transportation a special box with padded sides and spring-mounted false bottom has been found of considerable value. A small meter shop is maintained at Shelburne Falls for general repairs and shop testing of service meters.

In all routine testing 100 per cent accuracy is the objective of meter inspectors and is to be maintained within the closest possible limits. In shop testing of both service and standard meters separate elements and elements in series-parallel are calibrated within the closest possible limits over a range of power factor from 25 to 100 per cent and from 5 to 100 per cent load.

New installations are carefully checked for all data in connection with instrument transformers and meter constants previous to being put into actual service. All connections are at the same time rung out lead by lead, the diagram being drawn on the reverse side of the meter record card and checked for correctness. The internal connection of double-ratio current transformers is particularly noted. As soon as possible after the meter has gone into service an initial test is made. At this time kilowatt load registered by the meter is checked against connected load, and power factor, as indicated by separate meter element registration, is checked against the probable load power factor. When practicable, the connection check described by Kouwenhoven, interchanging one and three primary potential leads, is used as an additional check.

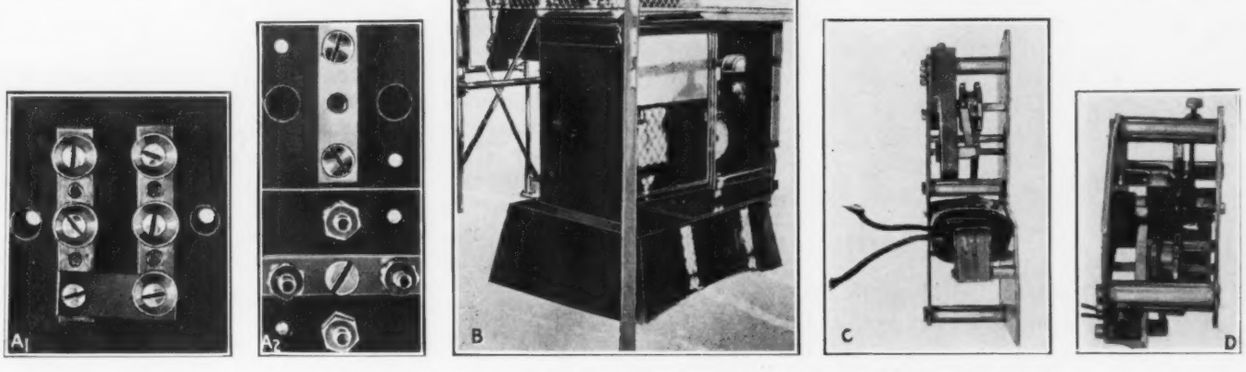


FIG. 3—A_1 AND A_2, TEST BLOCKS. B, OUTDOOR METERING IS DONE IN A WEATHERPROOF SHED. C AND D, TIMING DEVICE FOR METER TESTS

TESTING DEMAND METERS

A very large percentage of customers' installations include demand meters, all of the recording type. Several forms of these meters are in use on the system, the graphic type being predominant, with a number of the printometer type and some graphic wattmeters. In a few installations where power factor as well as demand records are required continuously two element meters of the Ingalls type are used in connection with reactive kilovolt-ampere-hour and kilowatt-hour meters. Installations on which power-factor records are required only at intervals are taken care of by two graphic power-factor meters of portable type. These are moved about from one installation to another at frequent intervals. It has been found advisable on the largest installations to use a separate watt-hour meter to operate demand meters of the types requiring contact devices in order to maintain the best accuracy at light loads in the energy-measuring watt-hour meter. Heating elements for all clock elements exposed to low temperatures have been found essential to satisfactory operation. All clock-driven devices are set up on an annual schedule for cleaning and oiling by an experienced clock repair man. It has been found that by placing all this clock work with one clock repair man who has familiarized himself with meter operation very satisfactory results are to be obtained.

Several spare meters of each of the various types used are kept in operation at the Worcester meter laboratory and are watched closely for faulty operation. The graphic type are operated for test purposes by the clock timing contactor so that very good check of timing qualities and recording accuracy are obtained. To conform with billing requirements demand charts must be taken from meters at weekly intervals. Owing to the widely scattered meter locations, it is impossible to have a meterman handle this work in such a short period, so that in many cases it has been necessary to train customers' electrical maintenance men to remove charts and keep clocks wound. This method undoubtedly presents many difficulties in obtaining the most efficient results from these meters. Ordinarily the men so trained take considerable interest in the proper operation of the meters, and, although the method is admittedly unusual, it works out quite satisfactorily and results in a great saving of money. The method, moreover, affords the customer an opportunity of using the charts to check his plant operation.

Equipment for the precise measurement of ratio and phase angles of instrument transformers has been lately added to the meter laboratory equipment. The apparatus has a range of 1,000 amp. and 22,000 volts. In the use of this apparatus stock transformers are tested at the laboratory and are used to replace transformers in service. All new installations are furnished with tested transformers. The process of checking all old installa-

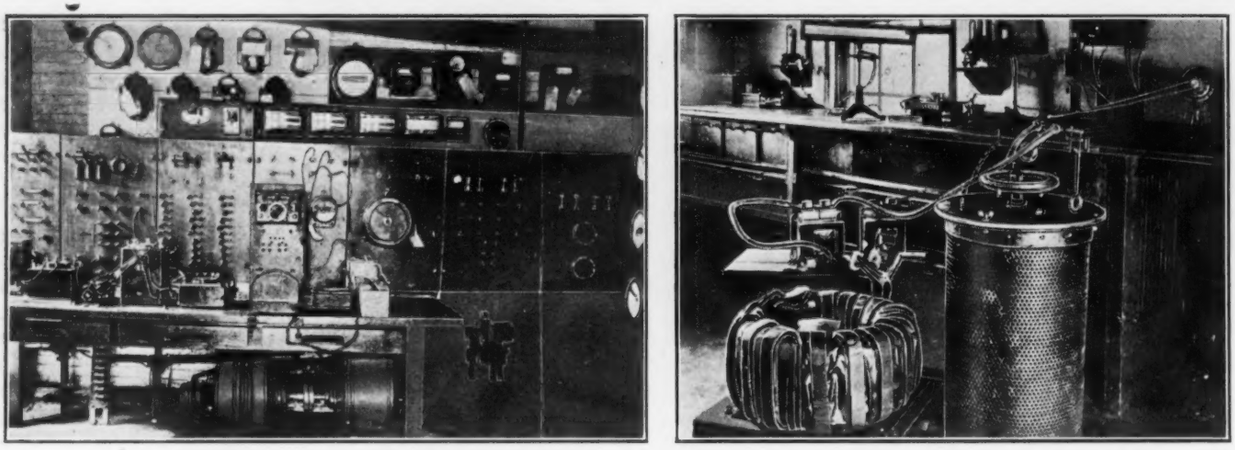


FIG. 4—THE GENERAL LABORATORY IS EQUIPPED FOR TESTING ALL THE METERS ON THE SYSTEM

tions is necessarily a gradual one and will require considerable time. For each calibrated installation curves of corrected meter registrations at various loads, at 50 and 100 per cent power factor and for the normal load power factor, are worked up for use of the metermen.

Station-indicating instruments are tested on an annual schedule by a meterman who has been sent to the manufacturer's factories for training. A stock of instrument transformers and high-voltage bushings, necessarily covering a very considerable range of voltages and currents, is kept at Worcester with a small branch stock at Shelburne Falls to cover emergencies.

The approximate annual cost of meter maintenance on the system is $15 per meter.

Impregnation of Enameled Wire Coils

Suggested Methods Based on the Fact that Certain Impregnating Compounds Contain Solvents Injurious to the Enamel

BY W. D. A. PEASLEE
Chief Engineer Belden Manufacturing Company, Chicago

THE impregnation of coils after winding is for the purpose of filling the air spaces in the coil, binding the coil into a more compact mass, excluding moisture and improving the heat-dissipating qualities. When a varnish is used for this purpose on coils wound with enameled wire certain precautions must be observed that are not necessary in a similar treatment of coils wound with textile-covered wires. This is due to certain characteristics of the enamel used to cover the wire.

Wire enamel is in general a varnish consisting of a base and a solvent. One type consists of a base and volatile solvent. The base consists of a high percentage of a drying oil and a small quantity of a hard resin. The base is reduced in consistency by a suitable volatile solvent so that the enamel will flow smoothly on the wire. This type of enamel when applied to the wires dries first by the evaporation of the solvent and then by the oxidation of the drying oil. This results in a drying from outside inward, with the formation of a skin of hard enamel on the surface at the start of the process. The oil is changed chemically by this drying, forming a new substance which is practically infusible and also practically insoluble in ordinary solvents. The resin of the film is the only portion seriously affected by heat or solvents, and it is protected by its intimate mixing with the oxidized oil.

This enamel is applied in from three to six coats, each coat being baked before the application of the next coat. The baking is done at rather high temperatures, and the ability of the enameled wire to withstand temperatures that will ruin ordinary textile coverings is a strong point in its favor.

In another type of enamel compounds and oils are used such that after the solvent has evaporated the remaining oils and bases solidify because of an action called polymerization, an action of instant molecular readjustment throughout the mass of the enamel. This method is quite distinct from the use of the oxidizing varnishes previously discussed and has certain technical features in its favor, producing a coating that is in general superior to that produced by the oxidizing varnishes. This varnish is also applied in several coats, each coat being baked before the application of the next coat.

It is obvious that in impregnating coils wound with enameled wires compounds must be selected and methods adopted that will not injure the enamel coating of the wire.

It has been found that petroleum naphtha is least active as a solvent of wire enamel, and therefore the varnishes used should contain nothing as a solvent but petroleum, benzine or naphtha. The practice of certain varnish manufacturers of using coal-tar products as solvents and of certain users in using alcohol as a thinner is probably responsible for more than half the difficulties encountered in impregnating coils wound with enameled wires.

In all cases avoid phenol products, coal-tar derivatives and alcohol in impregnating varnishes for enameled wires.

PROCESS WITH VARNISHES

Some varnishes are available having a polymerizing oil in the base, and these have been very successfully used as impregnating varnishes for enameled wire. In case of doubt as to the suitability of a varnish for such work it is well to consult the engineering department of the manufacturer of the wire used in the coil.

It is extremely difficult to dry the varnish on the interior of a deep coil. If baking is begun at a high

temperature, the progressive oxidation forms a hard skin of varnish on the outside, preventing the escape of solvent from the inner layers of the winding. This solvent remaining in the coil may attack the enamel of the wire and short-circuit the coil. Instances are known where after several months the inside coils were soft and sticky, and in these cases considerable trouble had developed from short-circuited turns.

The following instructions outline a process that has, with the necessary adjustment in time of drying, etc., to suit different coil designs, proved quite successful in impregnating coils wound with enameled wire.

METHOD OF IMPREGNATING ENAMEL WIRE COILS

1. Thin the varnish with petroleum naphtha (benzine) to the heaviest consistency that will give the required penetration. This can be determined only by trial. This specific gravity should be carefully recorded and should be maintained for all future work on this coil.
2. Dry the coils thoroughly. Heating at 105 deg. C. to 110 deg. C. in a well-ventilated oven is a very satisfactory method, the time of heating depending on the coil.
3. Cool coils to 80 deg. C. (approximately) and dip. In general it is not necessary to dip more than ten minutes at the most.
4. Drain until dripping stops. Upper portion during draining should be lower portion during baking.
5. Place the coils in a well-ventilated oven at 85 deg. C. (approximately) and raise the temperature slowly until the baking temperature is reached, after which the baking is finished at this temperature. The final temperature is usually between 100 deg. C. and 110 deg. C., but the instructions of the varnish manufacturer should be carefully followed in each case. The time required to raise the temperature from 85 deg. C. to the final temperature depends on the size of the coil and must be determined by experiment in each case. In ordinary work it may run from one to four hours. A second treatment is only necessary to produce a higher finish, and if adopted, the coils are simply dipped again after the first baking, removed at once and baked at finishing temperature to dry the thin enamel coating so obtained.

If this process with carefully worked-out adjustments as to time and temperature for the work in consideration is followed, no difficulty should be encountered in the impregnation of coils made of enameled wires.

The use of air-drying varnishes is in general limited to repair work and coil work in which the varnish is applied for a finish and to protect the coil from moisture, oil, etc. In this process the coil is simply dried and dipped in the varnish, removed immediately and dried in the air. The drying period for a coat applied in this manner is from fifteen minutes to three hours, depending on the varnish used. In no case should the coils be soaked in the varnish as it is practically impossible to dry the coil on the inside if the varnish is allowed to penetrate deeply into the winding. This process is suitable only for applying a surface coat and is not an impregnation. For a superior finish two or more successive dippings and dryings are often used. In any case the varnish must be thorougly dried throughout.

PROCESS WITH SOLID COMPOUNDS

Impregnating varnishes contain about 50 per cent of solids, the remainder being a volatile vehicle. One can therefore never completely fill the air spaces in a coil with varnish, as part of the varnish runs out when the coil is drained and about half of the remainder evaporates. As stated before, impregnation is employed to fill these spaces and so secure water exclusion, rigidity, and improved heat radiation. The last feature greatly influences aging of the coils by reducing the temperature in operation and effects economies in design, permitting the use of higher current densities for the same hot-spot temperature. Solid insulating compounds applied by the vacuum process or vacuum-pressure process effect a more complete filling of these air spaces.

However, more expensive equipment is necessary for this treatment, and the compound cannot be used well in rotating coils, as it is sure to be thrown out as the coils warm up. Indeed, on stationary coils there is a distressing tendency of the compound to flow under temperatures met with in ordinary overload conditions.

In using such compounds for enameled wires care must be taken that they do not contain materials that have a solvent action on the enamel or a material that combines with the enamel at impregnation temperatures. In general it is wise to consult the manufacturer of the enameled wire used as to the suitability of a particular compound.

If the coils have absorbent material between layers, they may be successfully impregnated with solid compounds by the vacuum-pressure process, as follows:*

1. Determine proper consistency to obtain desired penetration by trial. Do not use a temperature of more than 150 deg. C. (300 deg. F.) on coils made of enameled wire. The compound should be used at the consistency determined above for all future use on the same coils. Be sure the compound is heated throughout before turning it onto the coils.
2. Heat the coil in a well-ventilated oven at 110 deg. C. for one to four hours according to the coil.
3. Transfer at once to the impregnating tank and mount the coils so they will drain easily. Apply a vacuum for two to three hours according to the coil.
4. Close vacuum-pump valve to flood coils with the compound. A thermocouple should be placed in the part of the tank nearest the source of heat so that temperatures greater than 150 deg. C. (300 deg. F.) will be avoided. Raise the pressure in the tank to about 80 lb. per square inch and hold two to three hours according to the coil.
5. Drain compound out of tank and drain the coils for a time, dependent on the coil, but usually not over one-half hour.
6. Remove the coils from the tank, scrape off excess compound and bake in an oven at 110 deg. C. to 120 deg. C. for six hours to set the compound, if it is of such a type.

If the above procedure is followed with the necessary modifications as to time to suit the particular coil treated, the impregnation of enameled wires will be entirely satisfactory.

It has been the author's experience that, regardless of the quality of enameled wire used, more coils have been ruined in impregnating than in any other way. Manufacturers are continually confronted with the statement that this lot of wire would make first-class coils while the last lot would not. In the majority of such cases where it has been possible to trace the trouble to its source it has been found that the variation was not in the quality of the wire but in the way that it was impregnated.

It cannot be too strongly recommended that accurate and complete records be kept of the treatment of each particular type and kind of coil. These records should show clearly the specific gravity of the impregnating varnish or compound, the number of minutes necessary to dry the coil, the number of minutes necessary to submerge the coil to insure satisfactory penetration, the time required to drain the coil, the temperature of the oven when coil is placed in it and the temperature cycle until the treatment is completed. Moreover, instruments must be provided that will enable the operators to follow the directions given.

*Coils having non-absorbent paper or other material between layers are rarely impregnated.

Allocation of Electric Service Costs

Method of Cost Analysis Devised by an Iowa Company Applied to the Allocation of Service Costs to Various Classes of Consumers—Some Advantages of Accurate Cost Knowledge

By W. J. GREENE, C. F. SCHOONMAKER and C. B. GORTON

THE essential features of a method for obtaining unit costs of electric service, developed for the use of the Iowa Railway & Light Company, were outlined in a previous article. In this article it is proposed to take up briefly an example of the application of the method used in obtaining the unit costs of service of a utility operating its own generating plant in a small city which is assumed to have 800 residence consumers, seventy commercial-lighting "connected-load" consumers and thirty commercial power "connected-load" consumers. Four systems of service are assumed—general light and power, municipal lighting, special power, and rural. The monthly power-plant expenses are assumed to be: Energy, $1,752; capacity, $750, and indeterminate, $250. The distribution, commercial office, franchise and consumer elements of general expenses are assumed as given in Table I, column 18, of the example. The values used in the example are not taken from the records of any utility but are representative values.

METHOD OF ALLOCATING COSTS

In this article no attempt will be made to show the method of allocating power-plant, transmission and distribution substation expenses to transmission and distribution centers.

Table I shows the complete tabulation used in arriving at the final results. Columns 1 to 11 cover the load data and the ratios for allocating the costs to the four systems. Column 1 shows the kilowatt-hours to each system as determined by meters at the distribution center of the power plant. Column 2 gives the demand in kilovolt-amperes on the distribution center of each system at the time the combined load of all the systems is the maximum for the period. This demand is termed the peak responsibility. Average hourly loads are given in column 3, and the difference between the peak responsibility and the average hourly load of each system is given in column 4. That the sum of these differences equals the sum of the average hourly loads is only a coincidence. The chances are that this would happen rarely. The difference between the total amount of the second column, or the capacity measured in kilovolt-amperes, and the total amount of the third column, or capacity measured in kilowatts, is the kilovolt-ampere unused capacity that must be allocated to the various systems. This allocation is made by the unused-capacity ratios shown in column 5. By reference to column 4 it will be noted that the special power system has no unused capacity. Any 100 per cent load-factor system, off-peak system or partially off-peak system would have no unused capacity. A partially off-peak system has 100 per cent load factor referred to its peak responsibility for that part of its average hourly load that is equal to its peak responsibility and is off-peak by an amount equal to the difference between its average hourly load and its peak responsibility. The unused capacity of 70 kva. is allocated by the ratios in column 5 to the three systems whose demands during the peak period, or peak responsibilities, are greater than their respective average hourly loads, and the results of the allocation are shown in column 6. These results are added to the average hourly loads to obtain the period capacities shown in column 7, from which the period capacity ratios in column 8 are determined. The energy ratios in column 9 are derived from column 1. The indeterminate ratios in column 10 are the average of the period capacity, and the energy ratios and are used to allocate the indeterminate expense item. Ineffective-energy ratios are given in column 11. Ineffective energy is the remainder found by subtracting a system's average hourly load from its average daily peak responsibility. The ineffective fuel is the fuel required for banking boilers and bringing banked boilers to working conditions. The fuel ratios are given in column 12.

The power-plant expenses, column 13, are allocated to the systems by the ratios in columns 8 to 12 inclusive, and the results are shown in columns 14 to 17 inclusive. Further consideration of the municipal street lighting, special power and rural systems is omitted in this article.

The expenses of the general light and power system shown in column 14 and all other items entering into the general light and power system's expenses, except expense portion of the general expenses, are shown in column 18. Column 19 gives the total expenses with the expense portion of general expenses distributed. One hundred and five per cent is assumed as the expense element ratio. The next step is to divide the costs into consumer, capacity and energy groups. This is accomplished by the application of the factors given in Table II. The results are given in columns 20, 21 and 22. The number of consumers and consumer ratios are shown in columns 23 and 24. The consumer ratios are used to allocate to the classes the consumer expenses in items 5 to 14, column 20, and the results are shown in column 34. Columns 25 to 31 inclusive give the data on which the peak responsibility and maximum demand ratios are determined. Although the connected load is expressed in kilowatts, the fact that a motor horsepower is given the equivalent rating of 1 kw. places the connected load practically on the same basis as though measured in kilovolt-amperes, because, with the exception of motor load, most other loads included in a connected-load class are practically 100 per cent power factor. Columns 28 and 31 give these ratios. The peak responsibility ratios, column 28, are used to allocate to the classes items 1, 3 and 4, column 21, and the results are shown in column 35. The maximum-demand ratios, column 31, are used to allocate to the classes the remainder of the items in column 21. The results are shown in column 36. The monthly kilowatt-hours used by consumers and the energy ratios are given in columns 32 and 33. The energy expenses, items 2 and 3, column 22, are allocated to the classes by the energy ratios, column 33, and the results are shown in col-

umn 38. The consumer expense of each class is divided by the number of consumers in each class and the energy expense by the number of kilowatt-hours sold to each class. The sum of the peak responsibility and maximum-demand expenses of each class, column 33, is divided by the sum of the demands of the consumers in each respective class, and the results are the base-unit demand costs. Column 39 shows the total costs of each class. The unit costs are shown in columns 40 to 42. A tabulation of results is given in Table III.

The average cost per kilowatt-hour for all classes is 10.5 cents. Using this value, the average consumer in each class would have had a monthly cost of: Residence, $1.37; commercial light, $8.72, and commercial power, $56.60; whereas the actual costs are: Residence, $2.57; commercial light, $6.19, and commercial power, $29.45.

The $960 loss on the 800 residence consumers is made up by a gain of $177.10 on the seventy commercial-lighting consumers and $814.50 on the thirty commercial-power consumers. This illustrates very clearly how a flat rate per kilowatt-hour causes discrimination.

In the problem the average energy expense of the residence consumer is 18.42 per cent, that of the commercial-light consumer is 49.41 per cent, of the commercial-power consumer 67.89 per cent, and of the general light and power consumer 35.33 per cent of each consumer's respective total average costs. This shows that costs cannot be allocated equitably on a kilowatt-hour basis, since a watt-hour meter measures only the energy element of the total costs. It should be remembered that the values used in the example are not taken from the records of any utility, but are representative.

Some may criticise the assumption that the energy costs are the same for all consumers. The attention of such critics is directed to the fact that no expense items are included in energy costs except those that vary directly with the kilowatt-hours used by a consumer. Changes in energy costs due to any cause should be shared by all consumers in proportion to the kilowatt-hours used. Prevailing rates tend to give consumers the erroneous impression that unit energy costs should decrease with increase in kilowatt-hour consumption. This is the result of attempting to combine and collect a portion of all of the consumer and demand expenses with the energy expense on a kilowatt-hour basis.

ADVANTAGE OF COST KNOWLEDGE

A *Guide for the Determination of Rates.*—When a utility serves a number of communities from a common transmission system the costs chargeable to each com-

TABLE I—OPERATING DATA AND RATIOS BY WHICH SERVICE COSTS ARE ALLOCATED

This table also shows the process involved in using the cost analysis method of the Iowa Railway & Light Company and the final results expressed in costs to various classes of consumers.

Systems	1 Kilowatt-hours at Power Plant	2 Peak Responsibilities Kva.	3 Average Hourly Loads, Kw.	4 (2)—(3)	5 Unused Capacity Ratios (Col. 4), Per Cent	6 70 × Col. 5	7 Period Capacities (3) + (6), Kva.
General light and power	38,690	120	53	67	84	58.8	111.8
Municipal	2,920	12	4	8	10	7.0	11.0
Special power	14,600	10	20	..	0	0.0	20.0
Rural	2,190	8	3	5	5	4.2	7.2
Total	58,400	150	80	80	100	70.0	150.0

Systems	8 Period Capacity Ratios, Per Cent	9 Energy Ratios, Per Cent	10 Indeterminate Ratios Per Cent	11 Ineffective Energy Ratios, Per Cent	12 Fuel Ratios, Per Cent
General light and power	74.5	66.4	70.4	82	Ineffective fuel..10
Municipal	7.4	5.0	6.2	13	Effective fuel...90
Special power	13.3	25.0	19.2	0	
Rural	4.8	3.6	4.2	5	

ALLOCATION OF THE POWER PLANT EXPENSES

Power Plant Expense Items	13 Total	14 General Light and Power	15 Municipal Street Lighting	16 Special Power	17 Rural Lines
Ineffective energy	$175.20	$143.66	$22.78	.....	$8.76
Effective energy	1,576.80	1,047.00	78.84	$394.20	56.76
Indeterminate	250.00	176.00	15.50	48.00	10.50
Capacity	750.00	588.75	55.50	99.75	36.00
Total	2,752.00	1,925.41	172.62	541.95	112.02

GENERAL LIGHT AND POWER SYSTEM'S EXPENSES

	18 Total Before General Expenses	19 Total After General Expenses	20 Consumer Expenses	21 Capacity Expenses	22 Energy Expenses
Power plant expense items:					
1. Ineffective energy	$143.66	$150.84	.....	$150.84	.....
2. Effective energy	1,047.00	1,099.35	.....	.....	$1,099.35
3. Indeterminate	176.00	184.80	.....	92.40	92.40
4. Capacity	558.75	586.69	.....	586.69	.....
Sub-total	1,925.41	2,021.68	.....	829.93	1,191.75
Distribution expense items:					
5. Poles and fixtures	$350.00	$367.50	$183.75	$183.75	.....
6. Overhead conductor	200.00	210.00	105.00	105.00	.....
7. Transformer	60.00	63.00	6.30	56.70	.....
8. Transformer core loss	45.00	47.25	4.72	42.53	.....
9. Services	84.00	88.20	79.38	8.82	.....
10. Meter	125.00	131.25	105.00	26.25	.....
11. Meter shunt loss	35.00	36.75	36.75	.....	.....
12. Commercial office	240.00	252.00	252.00	.....	.....
13. Franchise	5.00	5.25	5.25	.....	.....
14. Consumer element	150.00	150.00	150.00	.....	.....
Sub-total	$1,294.00	$1,351.20	$928.15	$423.05	.....
Grand total	2,219.41	3,372.88	928.15	1,252.98	$1,191.75

GENERAL LIGHT AND POWER SYSTEM'S CONSUMER DATA

Classes of Consumers	23 Number of Consumers	24 Consumer Ratios, Per Cent	25 Sum of Consumer Demands, Kw.	26 Peak Responsibility Factors	27 Equivalent Peak Responsibilities (25) ÷ (26)	28 Equivalent Peak Responsibility Ratios, Per Cent
Residences	800	88.9	850	12.14	70	62
Commercial light	70	7.8	100	6.67	15	13
Commercial power	30	3.3	120	4.29	28	25
Total	900	100.0	1,070	.....	113	100

Classes of Consumers	29 Maximum Demand Factors	30 Equivalent Maximum Demands (25) ÷ (29)	31 Equivalent Maximum Demand Ratios, Per Cent	32 Monthly Kilowatt-hours	33 Energy Ratios, Per Cent
Residences	8.85	96	80	10,200	31.8
Commercial light	9.01	11	9	5,780	17.9
Commercial power	9.23	13	11	16,170	50.3
	.....	120	100	32,150	100.0

CONSUMER DEMAND AND ENERGY EXPENSES OF GENERAL LIGHT AND POWER SYSTEM

Classes of Consumers	34 Consumer Expense (20) × (24)	35 Peak Responsibility (21) × (28)	36 Maximum Demand (21) × (31)	37 Total Demand (35)+(36)	38 Energy Expenses (22)×(33)	39 Total Expenses (34)+(37)+(38)
Residences	$825.12	$514.56	$338.44	$853.00	$378.98	$2,057.18
Commercial light	72.40	107.89	38.07	145.96	213.32	431.60
Commercial power	30.63	207.48	46.54	254.02	599.45	884.10
Total	$928.15	$829.93	$423.05	$1,252.98	$1,191.75	$3,372.88

UNIT COSTS OF ELECTRIC SERVICE

Classes of Consumers	40 Consumer (34) ÷ (23)	41 Demand (37) ÷ (25)	42 Energy (38) ÷ (32) Cents
Residences	$1.03	$1.00	3.7
Commercial light	1.03	1.46	3.7
Commercial power	1.03	2.12	3.7

munity and to each consumer in the community must be known if it is desired to give equitable and non-discriminating rates. The information is not essential where political rates are made, although if the actual costs are known, efforts can be made to provide political rates that approach a cost basis. A knowledge of the costs does not prevent a utility from making any kind of a rate that will be acceptable and will bring in the total revenue required; but with the cost facts known the utility can make such provision as will protect it in case the business that is taken on at less than cost increases more rapidly than the profitable business. The utility will in such cases know how to make a proper readjustment of rates.

TABLE II—RATIOS ON WHICH EXPENSE ITEMS ARE ALLOCATED TO CONSUMER, CAPACITY AND ENERGY EXPENSE

Expense Items	Consumer, Per Cent	Capacity, Per Cent	Energy, Per Cent
1. Ineffective energy	...	100	...
2. Effective energy	...	...	100
3. Indeterminate	...	50	50
4. Capacity	...	100	...
5. Poles and fixtures	50	50	...
6. Overhead conductors	50	50	...
7. Transformer	10	90	...
8. Transformer core loss	10	90	...
9. Services	90	10	...
10. Meter	80	20	...
11. Meter shunt loss	100	...	...
12. Commercial office	100	...	...
13. Franchise	100	...	...
14. Consumer element	100	...	...

A Basis for Cost-Plus Sale of Service to Large Consumers.—The sale of energy to large power consumers on a cost-plus basis offers some advantages to the utility. The revenue thus obtained follows the cost of production much closer than it would with any form of rate schedule.

A Logical Method for Presenting Costs in Rate Controversies.—The knowledge of the costs of service for each class of consumers will become of greater and greater importance in rate controversies.

A Method for Determining Costs of Service in Each Town or City on a Common Transmission System.—Without an accurate, logical and equitable method for allocating the costs incurred by a utility operating a large system it would be very difficult to determine the true costs of service in each town or city served by the utility.

A Measure for Taking on New Business.—Unit costs provide an accurate measure for determining the value of any new business to the utility, especially such business as the utility is not required to take by its franchise.

A Measure for the Extension of Transmission or Distribution Lines.—The method may be used to determine how far lines can be profitably extended for new business under the existing rates. The utility therefore has a means of knowing whether each prospective customer will pay his portion of the costs of service.

A Method of Determining the "Rate of Return" from a Class of Consumers or a City.—The usual method of determining the revenue that would be considered equitable is to allow, in addition to the costs, a fair rate of return on the fair value of the property used and useful for the town or city. The method provides an accurate means for determining the rate of return on the property chargeable to any town or city. In using the method for this purpose interest on the money is omitted from the investment expenses. The property values are allocated by the same rules as the capacity expenses. The costs, allocated to the town or city, are deducted from the revenue, and the difference divided by the value of the property used and useful will give the rate of return realized on the property.

A Statistical Knowledge of the Business.—The benefits to be gained from a knowledge of unit costs depend to a large extent on the margin between cost and selling price. If an industrial company is selling its product for three times its total cost, knowledge of the exact costs in detail would not be very important. However, when an enterprise is compelled to operate on such a small margin as is a utility accurate unit costs of classes are of great importance. The utility must know in which class of consumers the losses are sustained before it can adjust rates.

A Method of Determining the Efficiency of Plant Operation.—The data necessary to determine unit costs will also permit of a daily check on the efficiency of plant operation. Few utility companies have installed the proper meters in the proper places to determine operating efficiencies of the various plant units. To realize the greatest advantage the proper data must be in such form that any decrease in efficiency can be detected immediately.

The results obtained in determining unit costs depend to some extent on the proper division of certain costs into their elements as given in Table II. For example, the steam plant's indeterminate expenses are allocated to capacity and output on a fifty-fifty basis because the exact relation has not been determined. Additional experience may show that a different division would give more accurate results. The other percentages for the separation of a system's expenses into consumer, demand and energy elements were selected after a careful analysis of each item. There can be no question that the effective energy expense is 100 per cent energy and the power plant capacity expense is 100 per cent capacity. These two items of expense constitute over 56 per cent of the total cost. The division of some of the other items is a matter of judgment, and a consensus of opinion is probably the only way of establishing results that can be accepted generally. The additional knowledge gained by other utilities applying the method may lead to a more exact determination of some of the values.

TABLE III—THE BILLS OF THE AVERAGE CONSUMER OF THE SEVERAL CLASSES UNDER THE ALLOCATION OF COSTS BY METHOD USED BY IOWA RAILWAY & LIGHT COMPANY

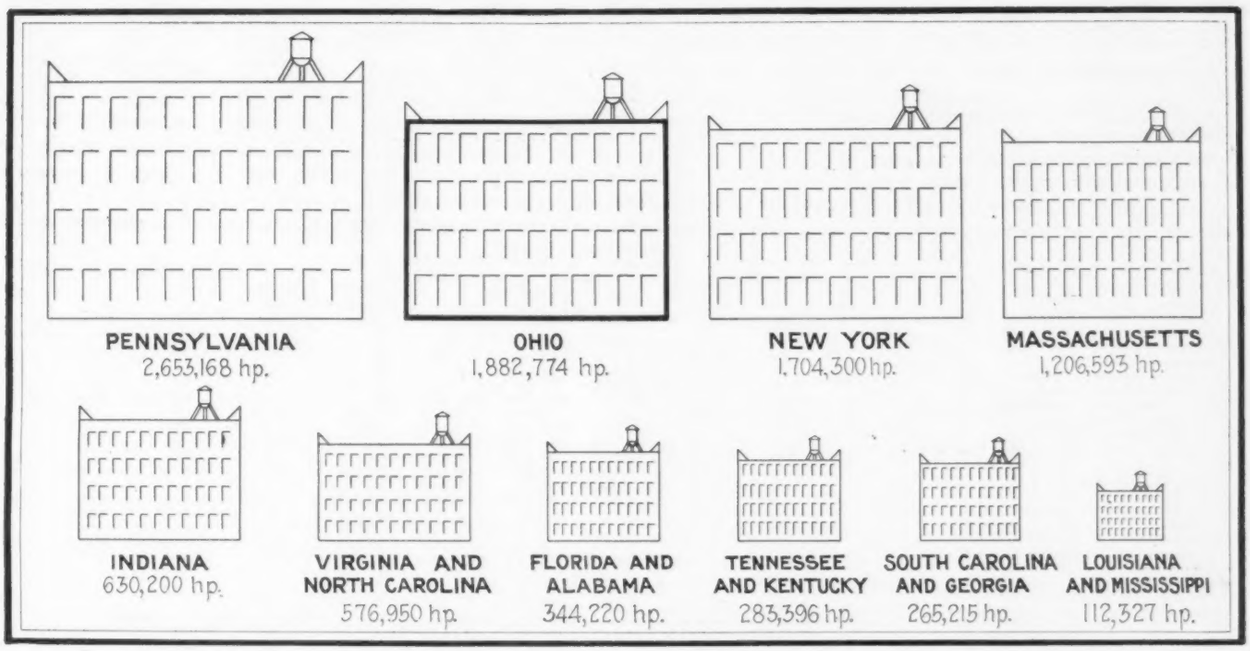
	Residence	Commercial Lighting, Connected Load	Commercial Power, Connected Load
Average, demand in kw	1.06	1.43	4
Kilowatt-hours	13	83	539
Monthly consumer cost	$1.03	$1.03	$1.03
Monthly demand cost per consumer	1.06	2.09	8.48
Monthly energy cost per consumer	48	3.07	19.94
Total monthly cost	$2.57	$6.19	$29.45
Cost per kw.-hr (cents)	19.8	7.5	5.5
Load factor (per cent)	2.74	8.0	18.5

The Iowa Railway & Light Company believes that an accurate knowledge of costs is essential to its further economic development and has arrived at the conclusion that, in addition to the generally recognized basic fundamental principles, there are other elements that have not been generally recognized in utility cost accounting, and believes that these elements must be recognized as characteristics of public utility costs and must be used in connection with the others as the foundation for the determination of unit costs.

Industrial Energy Consumption in Ohio

More than Half of the 2,820,452,000 Kw.-Hr. Consumed by Ohio's Industrial Plants and Mines in 1920 Was Used by the Iron and Steel Industry —Of the 130,437 Installed Motors, About 40 per Cent Are Under 5 Hp.

By ROBERT M. DAVIS
Statistical Editor Electrical World



HOW OHIO COMPARES IN ELECTRICAL POWER WITH OTHER STATES COVERED TO DATE BY "ELECTRICAL WORLD" SURVEY

ON ACCOUNT of the nature of its primary industries, Ohio was one of the chief sufferers during the industrial depression from which the nation is just emerging. The extent to which the machinery in the factories, mills and mines of the state was non-productive is clearly indicated from a survey just completed by the *Electrical World*, covering the years 1920 and 1921. In 1920 the total electrical energy consumed by industrial plants, mines and quarries of Ohio is estimated at 2,820,452,000 kw.-hr., while the energy consumed by the same plants and mines in 1921 is estimated at 1,936,540,000 kw.-hr., a decrease of 31.4 per cent. The iron and steel industry, the most important primary industry in Ohio,

TABLE I—SEGREGATION OF THE INDUSTRIAL LOAD IN THE STATE OF OHIO

These data are compiled from an industrial survey being conducted by the McGraw-Hill Company, Inc., under the supervision of the editorial departments of the *Electrical World* and *Power*, and cover plants in all industries employing more than fifty operatives

Industry	Companies Reporting: Total Number	Companies Reporting: No. Using Electrical Energy	Electric Generators—Direct Current: Number	Electric Generators—Direct Current: Total Rating, Kw.	Electric Generators—Alternating Current: Number	Electric Generators—Alternating Current: Total Rating, Kw.	Electrical Energy Consumed During 1920: Privately Generated, Kw.-hr.	Electrical Energy Consumed During 1920: Purchased, Kw.-hr.	Motors Installed: Number	Motors Installed: Total Rating, Hp.	Motors Installed: Number Under 5 Hp.	Distribution of Drives: Belt	Distribution of Drives: Chain	Distribution of Drives: Direct or Geared
Chemicals	41	21	10	818	5	1,275	8,029,250	7,888,685	1,503	16,173	508	1,250	92	161
Electrical equipment and machinery	37	26	9	2,270	2	500	9,087,659	17,975,185	2,518	20,249	1,337	1,665	74	779
Food and kindred products	71	52	22	2,626	7	1,026	4,874,950	25,952,752	1,418	16,640	593	1,183	332	1,003
Iron and steel and their products	380	312	192	41,192	73	61,288	236,015,047	690,985,693	26,959	503,149	4,535	10,891	682	15,386
Leather and its products	27	20	12	1,890	2	307	306,615	7,208,921	1,481	8,313	278	1,290	115	76
Lumber and its products	57	37	8	426	6	956	1,301,290	2,389,255	887	11,705	365	738	4	145
Metals and metal products other than iron or steel	41	21	4	95	15	423	264,000	11,399,938	1,290	8,781	734	944	47	299
Paper and printing	40	32	24	7,492	6	3,665	42,168,335	17,469,926	1,624	29,429	888	1,313	34	277
Railroad repair shops	16	12	7	647	5	1,500	5,808,000	4,246,816	724	11,416	133	310	37	377
Rubber	30	25	18	3,683	18	16,730	71,470,900	52,903,396	3,229	73,654	2,341	1,290	148	1,792
Stone, clay and glass	103	67	54	15,154	3	375	35,810,343	16,559,645	1,527	31,563	572	835	106	586
Textiles	73	41	15	579	5	1,175	1,015,900	2,776,094	1,380	4,343	1,078	429	145	806
Vehicles for land transportation	26	17	8	961	2	270	2,882,660	6,973,258	1,592	17,904	664	1,236	30	326
Miscellaneous	40	38	29	5,573	8	1,170	6,176,000	22,074,012	2,111	29,039	1,357	1,143	110	858
Bituminous coal mining	112	50	48	6,066	2	225	5,610,944	7,028,295	850	22,286	104	282	38	530
Tobacco	23	14	0	0	0	0	0	100,541	44	149	35	44	0	0
Totals for all industries of Ohio	1,117	785	460	89,472	159	90,885	430,821,893	893,932,412	49,137	804,793	16,522	24,843	1,994	23,401

TABLE II—"ELECTRICAL WORLD" ESTIMATE OF THE USE OF ELECTRICAL ENERGY IN OHIO IN 1920 AND 1921

Industry	Electric Generators: Direct Current No.	Direct Current Total Rating, Kw.	Alternating Current No.	Alternating Current Total Rating, Kw.	Electrical Energy Consumed: Generated in Private Plants, Kw.-hr. (1920)	Purchased from Public Utilities, Kw.-hr. (1920)	Total Energy Consumed in 1920	Total Energy Consumed in 1921
Bituminous coal mining	60	7,590	16	1,310	21,650,000	29,200,000	50,850,000	46,400,000
Chemicals	26	2,120	8	2,040	18,700,000	26,070,000	44,770,000	30,600,000
Electrical equipment and machinery	26	6,550	8	2,000	18,900,000	48,250,000	67,150,000	46,100,000
Food and kindred products	68	8,120	22	3,220	49,150,000	108,200,000	157,350,000	107,900,000
Iron and steel and their products	622	133,200	236	198,800	765,000,000	678,500,000	1,443,500,000	945,000,000
Leather and its products	15	2,360	3	406	3,848,000	6,385,000	10,233,000	6,990,000
Lumber and its products	10	533	7	1,120	2,540,000	8,370,000	10,910,000	7,450,000
Metals and metal products other than iron or steel	69	12,400	22	7,560	50,400,000	123,000,000	173,400,000	143,400,000
Paper and printing	37	11,400	9	5,560	64,100,000	64,900,000	129,000,000	88,100,000
Railroad repair shops	28	2,580	9	2,700	20,040,000	27,720,000	47,760,000	40,450,000
Rubber	49	10,000	49	45,500	194,000,000	99,000,000	293,000,000	200,000,000
Stone, clay and glass	101	28,300	6	700	67,000,000	92,300,000	159,300,000	118,900,000
Textiles	20	4,000	8	1,880	5,960,000	7,220,000	13,180,000	12,000,000
Tobacco	0	0	0	0	0	443,000	443,000	400,000
Vehicles for land transportation	9	1,130	2	270	3,392,000	40,600,000	43,992,000	29,400,000
Miscellaneous	91	17,500	29	4,250	66,000,000	72,200,000	138,200,000	94,200,000
Shipbuilding	5	1,000	2	2,660	3,720,000	7,023,000	10,743,000	1,000,000
Petroleum and natural gas (not refining)	1	82	0	0	36,000	135,000	171,000	200,000
Quarries	6	1,683	2	234	4,150,000	22,350,000	26,500,000	18,050,00
Totals for all industries of Ohio	1,243	250,548	438	280,210	1,358,586,000	1,461,866,000	2,820,452,000	1,936,540,000

TABLE III—"ELECTRICAL WORLD" ESTIMATE OF NUMBER AND RATING OF MOTORS INSTALLED IN INDUSTRIAL PLANTS OF OHIO

Industry	Motors Run by Purchased Energy: Number	Purchased Energy Total Rating, Hp.	Motors Run by Energy Generated in Private Plants: Number	Private Plants Total Rating, Hp.	Total Motors in All Plants: Number	All Plants Total Rating, Hp.	Motors under 5 Hp.	Distribution of Drives: Belt	Chain	Directly Connected
Bituminous coal mining	1,647	51,447	1,498	38,145	3,145	89,592	385	1,025	142	1,978
Chemicals	3,290	26,436	2,360	18,960	5,650	45,396	1,910	3,734	166	1,750
Electrical equipment and machinery	4,480	36,144	1,760	14,150	6,240	50,294	3,315	4,123	184	1,933
Food and kindred products	4,970	58,372	2,260	26,561	7,230	84,933	3,025	3,401	953	2,876
Iron and steel and their products	19,720	368,541	22,300	416,508	42,020	785,049	7,080	17,003	1,063	23,954
Leather and its products	1,260	7,060	760	4,260	2,020	11,320	379	1,758	157	105
Lumber and its products	2,010	26,589	610	8,056	2,620	34,645	1,078	2,180	12	428
Metals and metal products other than iron or steel	13,600	92,584	5,580	37,934	19,180	130,518	10,900	14,020	700	4,460
Paper and printing	1,770	32,096	1,750	31,650	3,520	63,746	1,924	2,846	74	600
Railroad repair shops	2,000	31,654	1,450	22,926	3,450	54,580	634	1,480	176	1,794
Rubber	2,560	58,581	5,040	115,006	7,600	173,587	5,510	3,034	349	4,217
Stone, clay and glass	2,680	55,559	1,950	40,388	4,630	95,947	1,737	2,530	322	1,778
Textiles	2,620	8,261	2,170	6,820	4,790	15,081	3,740	1,490	502	2,798
Tobacco	195	659	0	0	195	659	155	195	0	0
Vehicles for land transportation	6,550	73,608	386	4,333	6,936	77,941	2,890	5,385	131	1,420
Miscellaneous	5,390	74,116	4,930	67,747	10,320	141,863	6,640	5,586	538	4,196
Shipbuilding	294	7,495	156	3,983	450	11,478	197	66	8	376
Petroleum and natural gas (not refining)	11	137	2	37	13	174	4	13	0	0
Quarries	308	13,466	120	2,505	428	15,971	161	234	30	164
Totals for all industries of Ohio	75,355	1,022,805	55,082	859,969	130,437	1,882,774	51,664	70,103	5,507	54,827

TABLE IV—ALTERNATING-CURRENT MOTOR-OPERATING VOLTAGES OF INDUSTRIAL PLANTS IN OHIO

Industry	Number of Companies Reporting Various Motor-Operating Voltages: 90	110	120	125	160	210	220	225	230	235	240	250	410	440	450	460	480	500	550	2,200	2,300	3,800
Bituminous coal mining	..	...	...	...	...	...	6	...	...	...	...	...	...	2	...	...	...	...	...	1	1	....
Chemicals	..	1	...	...	...	...	9	...	...	...	...	...	...	3	...	...	...	...	...	....	....	....
Electrical equipment and machinery	..	3	...	...	...	...	12	...	...	...	...	...	...	5	...	...	...	...	...	1	...	....
Food and kindred products	..	4	...	...	...	...	22	...	...	...	...	...	...	5	...	...	...	...	...	2	1	....
Iron and steel and their products	..	6	...	1	...	1	117	...	9	1	...	3	...	45	...	...	...	2	...	10	5	....
Leather and its products	..	4	...	...	...	...	9	...	...	...	...	...	...	2	...	...	...	...	...	....	....	....
Lumber and its products	..	3	...	...	...	...	10	1	...	...	...	...	...	3	...	...	...	...	...	....	....	....
Metals and metal products other than iron or steel	..	1	...	...	...	...	9	...	...	...	...	1	...	4	...	...	...	...	...	1	1	....
Paper and printing	..	2	...	...	...	...	8	...	...	...	...	...	1	7	...	...	...	...	1	....	....	....
Railroad repair shops	..	...	...	...	...	...	2	...	...	...	1	...	1	3	...	...	1	...	...	....	....	....
Rubber	1	...	...	2	1	...	3	...	1	...	...	6	...	13	1	...	...	...	1	2	1	1
Stone, clay and glass	..	2	...	...	...	1	20	...	...	...	...	1	...	6	...	1	...	...	...	2	....	....
Textiles	..	2	1	...	...	...	14	...	...	...	1	...	...	2	...	...	...	...	...	....	....	....
Tobacco	..	4	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	....	....	....
Vehicles for land transportation	..	...	...	...	...	...	8	...	2	...	...	1	...	4	...	...	...	...	...	....	....	....
Miscellaneous	..	...	1	...	...	...	11	...	1	...	...	...	...	7	...	...	...	...	...	....	....	....
Totals for all industries of Ohio	1	32	2	3	1	2	262	1	13	1	2	12	2	111	1	1	1	2	2	19	9	1

TABLE V—TYPES OF FUSES USED IN INDUSTRIAL PLANTS IN OHIO

Industry	Total Number of Companies Reporting on Fuses	Standard Fuses: Number of Companies Using This Type	Fuses Used per Month: Number	Number per Motor	Refillable and Renewable Fuses: Number of Companies Using This Type	Fuses Used per Month: Number	Number per Motor	*Electrical World* Estimate of Fuses Used per Month by All Industrial Plants of Ohio: Standard	Renewable and Refillable
Bituminous coal mining	5	11	38	1.726	12	266	0.785	330	2,320
Chemicals	9	5	143	1.000	5	452	0.553	840	2,660
Electrical equipment and machinery	17	4	28	0.528	16	948	0.559	100	3,380
Food and kindred products	22	7	146	0.930	16	663	0.803	1,074	4,880
Iron and steel and their products	148	41	1,473	0.558	130	7,467	0.791	5,142	26,000
Leather and its products	9	3	22	0.440	9	318	0.535	69	996
Lumber and its products	7	5	61	0.455	4	45	0.500	715	525
Metals and metal products other than iron and steel	3	9	175	0.356	10	247	0.450	3,230	4,520
Paper and printing	15	6	109	0.392	13	395	0.681	443	1,630
Railroad repair shops	9	2	100	1.610	9	236	0.647	805	1,907
Rubber	13	4	297	0.883	10	287	0.837	3,320	3,210
Stone, clay and glass	31	12	332	0.898	25	467	0.758	1,563	2,190
Textiles	21	5	44	1.100	18	287	0.275	645	1,154
Tobacco	3	1	5	1.670	2	8	0.500	62	79
Vehicles for land transportation	11	0	0	0.000	11	684	1.540	1,195	8,750
Miscellaneous	12	4	142	0.648	12	721	0.766	1,262	10,560
Totals for all industries of Ohio	335	119	3,115	13.194	302	13,491	10.980	20,795	74,761

TABLE VI—DIRECT-CURRENT MOTOR-OPERATING VOLTAGES OF INDUSTRIAL PLANTS IN OHIO

Industry	Number of Companies Reporting Various Motor-Operating Voltages													
	110	115	120	125	210	220	225	230	240	250	440	500	530	550
Bituminous coal mining	..	..	..	..	1	7	..	2	..	21	..	..	..	2
Chemicals	3	..	..	..	..	3	..	1	..	..	1	..	..	..
Electrical equipment and machinery	4	..	..	1	..	5	..	2	..	..	1	..	..	..
Food and kindred products	5	..	..	..	..	4	..	2	..	..	..	..	..	..
Iron and steel and their products	11	2	..	..	1	56	1	19	3	14	1	1	2	..
Leather and its products	..	..	..	..	..	4	..	..	..	..	1	..	..	..
Lumber and its products	2	..	1	1	..	6	..	..	..	..	..	..	..	..
Metals and metal products other than iron or steel	2	..	..	..	..	3	..	1	..	..	..	..	..	..
Paper and printing	7	1	..	..	..	5	..	1	1	..	2	..	..	..
Railroad repair shops	1	..	..	..	..	1	..	1	..	1	..	..	..	..
Rubber	4	..	1	1	..	4	..	4	1	3	3	..	..	..
Stone, clay and glass	4	3	..	1	..	7	..	5	1	4	2	1	..	..
Textiles	4	1	..	..	..	9	..	..	..	..	..	..	..	..
Tobacco	..	..	..	..	..	1	..	..	..	..	..	..	..	..
Vehicles for land transportation	3	..	..	..	..	2	..	..	..	1	1	..	..	..
Miscellaneous	3	..	..	..	..	8	..	1	..	1	..	..	..	5
Totals for all industries of Ohio	53	7	2	4	2	125	1	39	6	45	12	2	2	7

reported the greatest decreased consumption from 1920 with 34.5 per cent.

During the past three years the *Electrical World* has conducted a country-wide survey to ascertain the extent to which electrical energy is being used by the various industries. The survey has been undertaken by states, and Ohio is the sixteenth state in the series. A detailed analysis of the industrial load of California appeared in the *Electrical World* for Aug. 28, 1920. A similar analysis of the industrial load for the Southern States appeared in the issue of June 25, 1921, and the industries of New York, Pennsylvania, Indiana and Massachusetts were covered in the issues of July 30, 1921; Dec. 31, 1921; Feb. 18, 1922, and June 24, 1922, respectively. Returns are now being received from Illinois, Michigan, New Jersey and Wisconsin, and the analyses of these states will appear in early issues of the *Electrical World*.

The returns received from the survey have been grouped under nineteen general industries as indicated in the accompanying tables. Complete returns were received from 1,117 mines and factories, scattered throughout the state, employing fifty or more operatives each. Of these plants, 785 reported the use of electrical energy as the main source of power. The data in the tables are for the year 1920, but an estimate of electrical energy consumption is also made for 1921, based upon the information furnished by the companies reporting. Reports from only a part of the industrial plants of the state, such as were received by the *Electrical World*, are useless, however, for practical purposes except as they are used as a basis for an estimate of the use of electrical energy by all industrial plants and mines of Ohio. The *Electrical World* has accordingly made such an estimate for the various items

TABLE VII—TYPES OF MOTOR CONTROL USED IN INDUSTRIAL PLANTS OF OHIO

Industry	No. of Companies Reporting on Motor Control	Number of Companies Reporting Various Types of Motor Control: Snap Switches	Knife or Safety Switches	Auto-Starters	Magnetic-Switches	Remote Control	Circuit Breakers
Bituminous coal mining	23	2	15	9	9	3	15
Chemicals	14	2	10	6	5	4	3
Electrical equipment and machinery	21	13	21	14	7	6	4
Food and kindred products	39	10	32	18	5	4	18
Iron and steel and their products	263	66	208	168	71	80	114
Leather and its products	16	3	16	11	6	2	4
Lumber and its products	18	3	17	7	1	2	6
Metals and metal products other than iron or steel	19	2	13	11	2	5	7
Paper and printing	21	9	19	11	4	6	8
Railroad repair shops	8	3	8	6	1	4	4
Rubber	21	10	19	16	11	11	15
Stone, clay and glass	42	10	31	18	10	5	13
Textiles	31	10	28	5	4	4	8
Tobacco	4	2	4	1	0	0	0
Vehicles for land transportation	13	7	10	10	6	6	2
Miscellaneous	25	7	23	10	4	4	5
Totals for all industries of Ohio	578	159	474	321	146	146	226

covered in the survey, based upon the information given in the reports received and supplemented by federal census data. These estimates are presented in the accompanying tables.

The total consumption of electrical energy by the mills, factories and mines of Ohio during 1920 is estimated at 2,820,452,000 kw.-hr., of which 1,358,586,000 kw.-hr., or 48.3 per cent, was generated in private stations of the plants and mines. There are estimated to be 1,681 generators installed in the private generating plants, with a total rating of 530,758 kw., of which

TABLE VIII—SIZE OF LARGEST AND SMALLEST MOTORS INSTALLED IN INDUSTRIAL PLANTS OF OHIO

Industry	Largest Motor Installed (Number of Plants Reporting): Under 10 Hp.	From 11 to 25 Hp.	From 26 to 50 Hp.	From 51 to 100 Hp.	From 101 to 300 Hp.	From 301 to 1,000 Hp.	From 1,001 to 5,000 Hp.	Over 5,000 Hp.	Smallest Motor Installed (Number of Plants Reporting): Under ¼ Hp.	From ¼ to ½ Hp.	From ½ to ¾ Hp.	From ¾ to 1 Hp.	From 1 to 2 Hp.	From 2 to 3 Hp.	From 3 to 5 Hp.	Over 5 Hp.
Bituminous coal mining	1	8	15	6	7	1	0	0	0	2	0	3	6	10	11	0
Chemicals	2	3	6	4	4	0	0	0	1	8	1	1	1	2	4	2
Electrical equipment and machinery	2	7	8	1	6	1	0	0	3	14	5	3	0	0	0	4
Food and kindred products	6	14	6	5	11	2	0	0	2	12	8	9	4	5	0	1
Iron and steel and their products	8	40	113	60	37	6	13	1	11	66	29	60	34	39	25	15
Leather and its products	2	15	6	0	0	0	0	0	0	1	1	5	1	2	0	1
Lumber and its products	3	7	13	4	0	0	0	0	0	8	4	5	1	2	5	1
Metals and metal products other than iron and steel	0	7	4	3	2	1	1	0	1	8	3	4	1	1	1	0
Paper and printing	4	7	6	0	9	1	0	0	3	10	3	4	2	2	2	1
Railroad repair shops	0	2	2	1	2	3	0	0	0	4	1	0	1	1	1	2
Rubber	0	0	0	3	14	6	2	0	3	8	0	8	0	2	1	0
Stone, clay and glass	4	15	14	9	8	3	0	0	3	9	1	10	7	7	10	4
Textiles	17	15	1	3	0	0	0	0	0	10	5	8	5	2	3	1
Tobacco	6	3	1	0	0	0	0	0	0	3	1	2	2	0	1	0
Vehicles for land transportation	1	5	6	3	3	0	0	0	2	5	4	0	2	2	2	0
Miscellaneous	5	13	8	2	6	2	0	0	5	11	5	3	5	3	2	1
Totals for all industries of Ohio	61	170	203	104	109	26	16	1	34	179	71	125	72	80	68	33

machines rated at 250,548 kw. are direct-current generators. By far the largest user of electrical energy in Ohio is the iron and steel industry, which in 1920 consumed 1,443,500,000 kw.-hr., or 51.2 per cent of the total electrical energy consumed for power purposes by the plants and mines of that state. The rubber industry, an industry peculiar to Ohio, is second, with a total consumption of 293,000,000 kw.-hr. in 1920. The extent to which operations in these two industries were curtailed during the late industrial depression is indicated by the large decrease in the amount of electrical energy consumed in 1921 as compared with 1920 and shown in Table II.

It is estimated that there are 130,437 electric motors installed in the factories and mines of Ohio, with a total rating of 1,882,774 hp. Of these motors 51,664, or 39.6 per cent, are under 5 hp. About 53.7 per cent of the machines are belt-driven, 42.1 per cent are directly connected, and only 4.2 per cent are chain-driven.

The returns indicate that fourteen voltages are in use in Ohio by mines and factories for the operation of direct-current motors and that twenty-two voltages are used in the operation of alternating-current motors. It appears that about 41 per cent of the direct-current motors are operated at 220 volts, but a large percentage are also operated at 110, 230 and 250 volts. Iron and steel mills particularly reported a high percentage of direct-current motors operated at other than 220 volts. More than one-half of the alternating-current motors are operated at 220 volts and about one-quarter are operated at 440 volts. It is apparent from these figures that there is much remaining to be done toward the standardization of voltages in Ohio. The survey indicates, however, that voltage standardization in Ohio is on a par with that attained in the neighboring industrial state of Pennsylvania, where seventeen voltages are used for the operation of direct-current motors and twenty-one voltages are in use for the operation of alternating-current motors. On the other hand, reports from the intensely industrial state of Massachusetts indicate that voltage standardization has played a very large part in the electrical generating industry there. The details of motor-operating voltages in Ohio will be found in Tables IV and VI.

More than 85 per cent of the companies reporting on types of motor control used knife or safety switches exclusively or in conjunction with other types of motor control. About 58 per cent of the companies reported the installation of automatic starters, and only 41 per cent reported circuit breakers in plants or mines.

TABLE IX — FREQUENCIES USED IN INDUSTRIAL PLANTS OF OHIO

Industry	Total Number of Companies Reporting on Frequency	Number of Companies Reporting Various Frequencies Used (The first figure gives number of phases; the second figure the number of cycles.)						
		1–25	2–25	3–25	3–40	1–60	2–60	3–60
Bituminous coal mining	14	..	..	..	..	..	2	12
Chemicals	14	..	..	..	..	1	...	13
Electrical equipment and machinery	23	..	1	..	..	..	1	21
Food and kindred products	31	..	..	3	..	1	1	26
Iron and steel and their products	250	..	..	29	..	6	9	206
Leather and its products	11	..	..	..	..	..	1	10
Lumber and its products	16	..	..	..	..	..	1	15
Metals and metal products other than iron or steel	17	1	..	1	..	..	1	14
Paper and printing	14	..	..	3	..	..	..	11
Railroad repair shops	9	..	..	1	..	..	1	7
Rubber	22	..	1	1	..	..	1	19
Stone, clay and glass	37	..	..	..	1	..	5	31
Textiles	21	..	..	1	..	..	3	17
Tobacco	5	..	..	..	..	2	2	1
Vehicles for land transportation	13	..	..	..	..	..	3	10
Miscellaneous	23	..	..	..	..	2	1	20
Totals for all industries of Ohio.	520	1	2	39	1	12	32	433

One of the iron and steel plants reported an installation of an 8,000-hp. motor, but only seventeen companies in the state reported motors of more than 1,000 hp. More than 33 per cent of the companies reported the largest motor as under 25 hp. Slightly more than one-quarter of the companies reported that the smallest motor installed ranged between $\frac{1}{8}$ hp. and $\frac{1}{4}$ hp.

Over 83 per cent of the plants and mines use three-phase, 60-cycle service, in the operation of their motors, and 7.5 per cent reported the use of two-phase, 25-cycle service. Of the other odd frequencies used, two-phase, 60-cycle service was used by thirty-two companies. The use of odd frequencies to such a large extent is probably due to the continuous operation of private electric generating plants which were installed several years ago. Table IX shows the use of the various frequencies by the industrial plants and mines of the State of Ohio.

The use of refillable or renewable fuses was reported by 302 out of 335 companies, as against 119 companies using standard fuses. A large number of companies reported the use of both types. The figures are quite different from those reported by the industrial plants of Massachusetts, where 173 out of 269 companies reporting used standard fuses as against 158 companies using refillable and renewable fuses. It is estimated that 95,556 fuses of all types are used per month by all the plants and mines in the aggregate.

TABLE X—"ELECTRICAL WORLD" ESTIMATE OF TOTAL PRIME MOVER EQUIPMENT IN INDUSTRIAL PLANTS OF OHIO

Industry	Total Hp. Prime Movers in Industrial Plants	Steam Engines		Steam Turbines		Internal Combustion Engines		Waterwheels		Boilers	
		No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.
Bituminous coal mining	84,578	650	79,949	4	3,275	120	1,354	0	0	318	76,000
Chemicals	54,184	121	33,890	11	18,002	18	1,884	4	408	199	47,400
Electrical equipment and machinery	7,271	22	4,533	1	670	10	2,068	0	0	44	10,600
Food and kindred products	157,514	754	121,881	100	11,371	128	18,024	68	6,238	509	121,600
Iron and steel and their products	1,104,334	2,600	810,541	98	218,656	477	74,437	5	700	2,860	682,500
Leather and its products	8,245	28	6,818	1	822	4	550	1	55	29	6,970
Lumber and its products	55,621	264	48,300	2	657	53	6,544	1	120	272	65,200
Metals and metal products other than iron or steel	55,351	148	35,816	2	3,799	125	15,426	3	310	151	36,200
Paper and printing	71,849	206	55,069	18	11,627	66	3,024	36	2,129	292	69,900
Petroleum and natural gas (not refining)	153,083	1,172	24,274	0	0	6,134	128,809	0	0	117	28,000
Quarries	35,151	419	34,162	0	0	56	961	1	28	163	39,000
Rubber	111,821	62	32,043	29	77,657	15	1,792	3	329	401	96,300
Stone, clay and glass	146,433	928	122,843	4	10,720	173	12,720	1	150	492	117,600
Shipbuilding	6,724	27	6,617	1	10	1	97	0	0	31	7,500
Textiles	7,938	25	6,124	4	1,120	5	644	1	50	30	7,260
Tobacco	87	1	50	0	0	1	37	0	0	1	52
Vehicles for land transportation	15,739	54	12,967	1	440	19	2,332	0	0	51	12,220
Miscellaneous	106,736	255	83,483	15	17,631	45	5,501	1	121	435	104,000
Ra lroad repair shops	34,226	111	26,977	3	5,187	17	2,062	0	0	123	29,300
Totals for all industries of Ohio	2,216,891	7,847	1,546,337	294	381,644	7,467	278,266	125	10,638	6,518	1,557,602

Testing Transformers for Characteristics

Compact and Convenient Compilation of Methods, Instruments Required and Sequence of Tests for the Engineer Who Is Occasionally but Not Regularly Engaged in Such Work

By R. F. GOODING
Superintendent of Construction, Tucker & Laxton, Charlotte, N. C.

MANY small companies buy their power on a peak basis, and if they are using transformers with a high iron loss, they are paying for more energy than would be necessary if more care had been exercised in selecting the units. One company in Buffalo changed from one make of transformer to another largely for this one reason. Under these conditions it would be money well invested for such a concern to buy several units of different makes and run a competitive test in its own shop to determine the one most suitable for its particular use. Such tests would also be of great value in determining future purchases. By making these tests the company would furthermore be giving valuable experience to its men and would develop a force competent and anxious to look after its transformers properly. Transformers should be inspected occasionally at least, but the ordinary distributing transformer hardly ever has its top taken off except in case of trouble. Then it's too late! Some units should be tested when purchased and again after a year or eighteen months to see whether the iron has "aged." If the proper silicon steel is used, there will be no appreciable aging, but this can be determined only by such tests.

SHOULD PURCHASE ON GUARANTEE

In buying transformers the purchaser should obtain the manufacturer's guarantees as to iron loss, exciting current, efficiencies, reactance, impedance and regulation at 100 per cent and 80 per cent power factor. If the order is a large one, he may ask for a certified test sheet from the maker, this test to be on one unit only of each different size. If willing to pay the extra charge made by some manufacturers for witness tests, he may go to the factory and see them tested himself. Or he may decide to verify some of the guarantees by testing some of the units in his own shop. In either of the last two cases the procedure will be somewhat similar to that outlined below.

Resistance.—The unit to be tested should remain in the building for several hours (eight or ten) so that the temperature of its windings will be the same as that of the surrounding air. In making this test a direct-current voltmeter, direct-current ammeter, variable resistance and some source of direct-current power are necessary. Connect instruments as shown in Fig. 1A, then close switch and take a preliminary reading. The direct current used in this test should usually be about 25 per cent of the normal full-load current, and this value should not be exceeded very much for fear of overheating the windings and obtaining incorrect results. After taking preliminary reading adjust rheostat to give approximately the current desired. Close switch and take simultaneous readings of voltmeter and ammeter. Take three or four such readings, changing rheostat each time in order to arrive at a good average value. Applying Ohm's law ($I = E/R$) gives the resistance in each case, and the average value of all results obtained is the one to use. Resistances of both high-tension and low-tension windings should, of course, be taken.

Care should be exercised to see that the current reaches maximum steady value before readings are taken, otherwise the induced electromotive force produced by changing flux may introduce a considerable error. It may often take several minutes for the current to reach a steady value, and this makes it doubly important to use a relatively small current in order to prevent overheating of the windings. When testing high-potential units the direct current should be built up and reduced very gradually, as a rapid change in current with its attendant change in flux may produce excessive voltage, tending to injure, or even puncture, the insulation.

Before commencing this test an approximate estimate of the resistance and the necessary meter scales can be made as follows:

Assume a 25-kva., 2,300/230-115-volt transformer with a full-load efficiency of 97 per cent. Then the losses are 3 per cent and the copper loss probably twice the iron loss, or 2 per cent and 1 per cent respectively. With the total copper loss of 2 per cent, it is safe to assume that it is equally divided between the high-tension and the low-tension coils, or 250 watts each. Then 25,000/2,300 = 10.9 amp., say 10 amp. primary current. Secondary current would then be approximately 100 amp. Then for the primary with a copper loss of 250 watts, $I^2R = 100$, $R = 2.50$, so the resistance of the primary would be 2.5 ohms. Secondary resistance would then be 0.025 ohms. Such values are sometimes of use as a check on the readings obtained.

VOLTMETER MAY INTRODUCE ERROR

When the resistance of the low-tension coil is too low to give a good reading on the scale of the direc-current ammeter, a milli-voltmeter should be used. If especially accurate results are desired, correction must be made for the current taken by the voltmeter coil. With an ammeter reading of 2 amp. and a voltmeter reading of 5 volts, showing a resistance of 2 ohms and a voltmeter resistance of 150 ohms, the voltmeter current $I = 5/150 = 0.03$ amp. Then the actual current through the high-tension winding is 2 — 0.03 = 1.97 amp., and the true resistance = 5/1.97 = 2.54 ohms. This shows with the voltmeter in circuit an error of only 0.16 per cent, which for all practical purposes may be neglected.

When the temperature is different from 25 deg. C all readings should be corrected to this temperature. This is done by the following formula: Resistance at

25 deg. C=*measured resistance*÷$(1 + 0.0038T)$ where T is the number of degrees above or below 25 deg. C., at which measurement was made. When measurement is made at a temperature above 25 deg. T is positive in value; for measurements below 25 deg. it is negative. For good average results it is customary to use 0.004 instead of 0.0038, thus making it slightly easier to calculate the resistance.

SHORT-CIRCUIT SWITCHES ARE DESIRABLE TO PROTECT METERS

The sketches show short-circuiting switches for the alternating-current ammeters and indicating wattmeters. Although these switches are highly desirable, they are not absolutely necessary. However, with them it is possible in case of excessive currents to short-circuit the instrument immediately and prevent serious damage to the coils. The normal position of these switches is closed, and when taking a preliminary reading the switch should barely be opened so that if the current is excessive the switch can be immediately reclosed, thus getting the instrument out of circuit. When it is desirable to disconnect the voltmeter from the circuit before reading other instruments, this can be done in the case of most portable voltmeters by merely releasing the push-button which disconnects the voltmeter from the circuit.

Iron Loss and Exciting Current.—Iron loss is made up of two parts—(1) hysteresis loss and (2) eddy-current loss. The hysteresis loss depends upon the quality of iron used in the laminations and varies directly as the 1.6 power of the magnetic density. But the density varies directly as the voltage and inversely as the frequency, therefore iron loss increases with an increased voltage but decreases with the higher frequency. If the voltage is increased 10 per cent, this will increase the iron loss about 60 per cent and the magnetizing current approximately 100 per cent. An increase in voltage of more than 10 per cent will raise the magnetizing current sufficiently to cause excessive heating and will materially reduce the power factor of the system.

Iron loss is dependent also on the wave form, a peaked wave giving a lower loss (sometimes 5 to 10 per cent lower) than the sine wave. Guarantees are based on normal voltage of sine-wave shape and normal frequency. It is comparatively easy to obtain normal voltage and frequency, but not always such a simple matter to have a sine-wave current for testing purposes. It is customary, therefore, in this test to use an iron-loss voltmeter, an instrument which at some particular voltage indicates the same iron loss as would be produced by a sine wave of rated voltage and frequency. When the actual root-mean-square voltage impressed on the transformer is such as to produce the same iron loss as would be caused by the sine wave of normal frequency and voltage, this instrument indicates normal voltage on one of its scales; the other scale is calibrated in watts and indicates watts loss in the instrument itself.

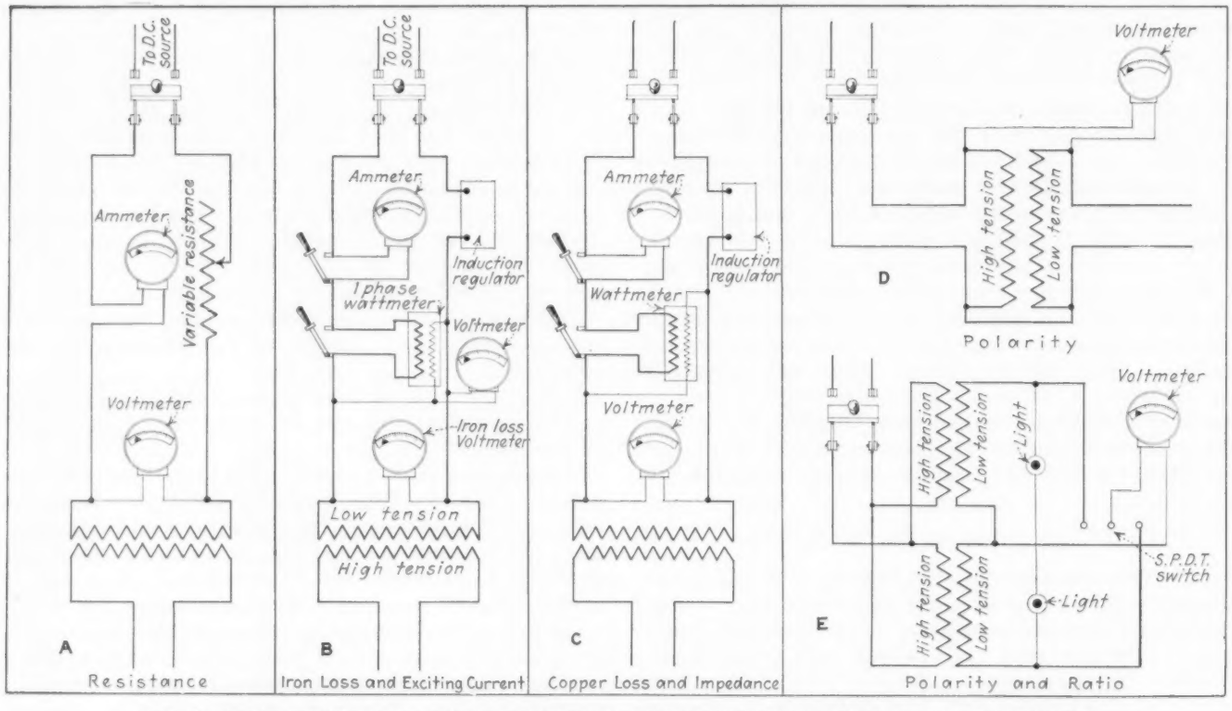


FIG. 1—GREAT PRECISION SHOULD BE REQUIRED WHEN TESTING TRANSFORMERS AND A CONVENIENT ARRANGEMENT OF SWITCHES FACILITATES THE WORK

It is customary in transformer specifications to give the iron loss in watts. This figure is considerably different from the apparent loss in watts found by multiplying the exciting current by the voltage at which current is measured. For 25-cycle transformers the apparent watts will be approximately six times the true watts, and for 60-cycle units about twice the true watts.

EXCITING CURRENT CAN BE SEPARATED INTO COMPONENTS

As its name implies, exciting current is that current necessary on one winding at normal voltage to produce normal voltage on the other winding when open-circuited. This exciting current is composed of two parts—(1) magnetizing current and (2) the iron-loss component; then $Ie^2 = Im^2 + Ii^2$. The iron-loss com-

ponent is obtained by dividing the watts iron loss by the rated voltage. Magnetizing current then can be obtained from the formula just given. For making the iron-loss and exciting-current test the instruments necessary are an alternating-current ammeter, an alternating-current voltmeter, an iron-loss voltmeter and a single-phase indicating wattmeter. Connections are indicated in Fig. 1B. With connections as outlined, adjust voltage until the iron-loss voltmeter indicates normal voltage, reading standard voltmeter at the same time. Then disconnect iron-loss voltmeter and adjust voltage until the root-mean-square voltmeter indicates the same voltage as when the iron-loss voltmeter was in circuit. Read ammeter and wattmeter simultaneously. If the results are to be very accurate and the voltage is steady, the voltmeter should be disconnected before reading the ammeter and wattmeter. However, leaving it in circuit will cause no great variation, as its losses are very small. The wattmeter may then be corrected by subtracting the watts loss in its shunt coil from the instrument reading. This is a refinement which will hardly be necessary in ordinary commercial testing.

The iron-loss test is usually made on the low-tension side of the transformer, since this requires the handling of lower-voltage apparatus and on the ordinary distributing transformers obviates the necessity of current and potential transformers.

Copper Loss and Impedance.—The copper loss is the watts necessary to circulate full-load current through the two windings. Knowing the resistance of high-tension and low-tension windings, it can easily be calculated from the formula $I^2R_{total} = I^2_{ht} \times R_{ht} + I_{lt}{}^2 \times R_{lt}$. The calculated value is usually lower than the measured value on account of the eddy currents due to unequal distribution of currents in the conductors and a small core loss caused by the amount of flux necessary to circulate full-load current in the short-circuited winding. This calculated value will usually be about 20 per cent lower than wattmeter reading, and for transformers designed for rotary converter service the calculated loss will be 40 to 50 per cent lower than the wattmeter reading.

VALUE OF COPPER LOSS OBTAINED BY SHORT-CIRCUIT TEST

In order to obtain the copper loss, short-circuit one winding—usually the low-tension—and impress on the high-tension enough voltage to cause full-load current in it. This voltage will usually be between 6 and 10 per cent of the rated voltage. A wattmeter inserted in the high-tension circuit will then give this total loss.

The impedance drop is that percentage of normal full-load voltage necessary on one winding to circulate full-load current in the other winding when short-circuited.

The copper-loss and impedance volts can be measured at one time with connections as indicated in Fig. 1C. A very low voltage should first be applied to avoid excessive current. Voltage should be varied by means of an induction regulator or a transformer with variable taps in preference to using a series resistance which may introduce a serious error. Having made a preliminary test, bring up voltage until full-load current is obtained in the short-circuited winding. Read impedance volts, taking care that the reading is directly across the transformer terminal board and that the voltmeter leads are fairly short. Read ammeter and wattmeter simultaneously. Leaving the voltmeter in circuit while reading the other two instruments introduces a small error which can be corrected by subtracting its I^2R loss from the wattmeter reading. If voltage is steady, disconnect voltmeter before reading ammeter and wattmeter. The temperature of the coils, etc., should be carefully noted as copper-loss guarantees are now made on the wattmeter basis at 75 deg. C. These readings should be made quickly in order to avoid undue heating of the coils.

VALUE OF IMPEDANCE IS DESIRED FOR PARALLEL OPERATION

It is often very desirable to know the exact impedance of a transformer in order to determine whether or not it will parallel with other units of known impedance. As a general proposition, like transformers of the same make parallel satisfactorily, but if one be a new type and the other several years old there may be considerable doubt as to their satisfactory operation. If there is a slight difference in the impedance values derived, fairly good operation can be obtained despite small circulating currents. However, if these values differ widely, it is a warning that the three units will not operate satisfactorily in parallel. Even in this case, if two of the units have the same impedances, they may be connected in open delta and give enough power to tide over until a third unit can be obtained or one with a different value of impedance.

Reactance.—For ordinary distribution transformers it is not necessary to know the reactance if the impedance be known. However, in the case of power transformers on large systems or long lines, the reactance is generally the value used in the calculation of system short-circuit possibilities (see articles by the writer, ELECTRICAL WORLD, Oct. 18, 1919; Nov. 15 and 22, 1919; April 3, 1920; April 24, 1920). The reactance can always be obtained from the manufacturer when asking for bids, or, if not given on the nameplate of old transformers, by sending complete nameplate information to the manufacturer. It can also be calculated, when necessary, as follows (N. E. L. A. "Handbook"):

Let

Z = total impedance of transformer windings referred to primary (high-tension) in ohms.

r_t = total resistance of transformer windings referred to primary, in ohms.

X = total reactance of transformer windings referred to primary, in ohms.

r_p = resistance of primary in ohms.

r_s = resistance of secondary in ohms.

N = ratio of transformation.

Then from copper-loss test:

$$Z = \frac{E}{I}\left(\frac{\text{impedance volts}}{\text{full-load current}}\right),$$

$$r_t = r_p + N^2 r_s, \text{ and}$$

$$X = \sqrt{\frac{E^2 - r_t^2 I^2}{I}} = \sqrt{Z^2 - r^2}$$

Having got the reactance in ohms in terms of high tension as per above equations, multiply this by the full-load current (high-tension) and divide by high-tension voltage to obtain reactance drop in per cent. Similarly the impedance drop in per cent will be obtained by multiplying the impedance in ohms by the high-tension full-load current and dividing by high-tension voltage. Knowing the reactance and impedance

drops in per cent, the resistance drop is obtained from the formula:

$$\text{Resistance drop} = \sqrt{(\text{impedance drop})^2 - (\text{reactance drop})^2}$$

The values of reactance and resistance drops in per cent will be found very useful when determining regulation.

Regulation Greatly Affected by Reactance

As a general proposition it is found that transformers with high reactance are cheaper to build than low-reactance units, but, of course, they give poorer regulation. Transformers designed for use with rotary converters usually have a reactance of 12 to 15 per cent because this tends to increase the direct-current voltage with increase of load. In favor of high-reactance transformers it must be remembered that they reduce the short-circuit values on large systems and thus permit the use of much cheaper oil circuit breakers, structures, etc. These advantages must be weighed against the disadvantage of poorer regulation, and transformers must be selected which while limiting the short-circuit possibilities will also allow fairly good voltage regulation. This question becomes important only on large systems.

Polarity.—It is not often necessary to test the polarity, but this can easily be done when desired. It is understood that if the high-tension and low-tension leads on one side are connected together, and voltage applied to one winding, the voltage across the two free terminals (the ones not connected together) will be (1) the difference of the high-tension and low-tension voltage for negative or subtractive polarity and (2) the sum of the high-tension and low-tension voltages for positive or additive polarity.

Power Club Recommendations Are for Subtractive Polarity

The Electric Power Club recommends for power transformers that all units over 200 kva. shall have subtractive polarity, regardless of voltage rating. On distribution transformers of voltage rating above 7,500 and in sizes up to 200 kva. subtractive polarity is standard; but on sizes 200 kva. and smaller with voltage rating of 7,500 and below the club recommends that the manufacturers adhere to their own standards, which are almost all for additive or positive polarity on the transformers.

To determine the polarity of a 2,300/230-115-volt transformer, connect apparatus as shown in Fig. 1E and apply, say, 230 volts to the primary or high-tension side. This would give 23 volts on low-tension side. Then for subtractive or negative polarity the volmeter reading will be 230-23 = 207 volts, and for additive or positive polarity 230 + 23 = 243 volts.

But what a customer wants to know is not whether a transformer has positive or negative polarity, but whether it has the same polarity as the ones it is to work with. To determine this point then, connect the unknown transformer with the one of known characteristics as shown in Fig. 1E, having the primaries (high-tension) in parallel and secondaries in series. If the lamps light up, the polarities are the same, and, moreover, if the voltages as indicated on the voltmeter are identical, the two units also have the same polarity.

The second part of this article will be published in the next issue of the *Electrical World* and will discuss temperature, regulation, efficiency and voltage tests.

"Selling" the Sales Department to the Organization

Central-Station Executives and Employees Must Be Made to Realize the Possibilities of Business Development Through the Activities of the Sales Department

By Cyrus Barnes
General Sales Manager Charles H. Tenney & Company, Boston

CENTRAL-STATION men willing to look facts in the face realize that throughout the industry as a whole the opportunities before our sales departments are far from fully appreciated today either by executives or by employees. There are many notable exceptions, of course; but it is undeniable that a great number of companies have never recovered in their commercial branches from the curtailment enforced upon them by the war. It is also unfortunately true that many other central-station companies have never been really "sold" upon the question of sales development. I believe that the time has come for a new start to be made, because the opportunities for the sale of electrical appliances and the supply of energy to them by central stations are nothing short of amazing. The central station is the electrical sponsor of its community and will continue to be so. If it falls short of its mission in the exploitation and merchandising of appliances to the public, it fails to measure up to modern requirements of service.

Unless a doctor has enough confidence in his own medicine to use it in his own family, his progress is bound to be unsatisfactory, and the same thing may be said of electrical men who fail to use appliances in their own homes. Right here is the point of departure from old ways. More than one electrical census has shown that executives and employees are neither testing nor owning many of the latest household appliances. In fact, a surprising amount of ignorance exists in our own industry as to the appliances available and their service capabilities. Many executives who travel extensively in their home states and vicinity have never visited any of the leading appliance factories in their own neighborhoods, and many others have failed to make use of opportunities to experiment with electrical conveniences in their homes as these devices have been developed. We have all been busy as the industry has hit its stride toward larger service, and so there has been a natural tendency to pass by opportunities which we can no longer afford to neglect.

In some companies, I venture to say, even the president's house is unwired for electric service. I heard of one case only a few days ago where the president's house, within a mile of the main generating station and less than half a mile from the main business street of a city of well over 100,000 people, used gas from the competing company for domestic illumination. In some of our own companies we have found that our employees and our executives, too, have been paying more money every month for gas service from the competing utility in the home town than for electricity supplied by their own plants—and the explanation is not that their own companies gave them either free or discounted service!

"Sell yourself continuously" should be the motto of every electrical man in regard to the use of appliances. Nothing is more important in the prosperous develop-

ment of our sales departments than that our friends and neighbors shall see us using in our own homes the conveniences which we know are worth while and which we are trying to sell to the community at large. I have found cases where the terms on which employees could buy appliances were actually less favorable than those given to customers outside the company. The most liberal terms are justified in order to place appliances in the homes of employees. Credit should naturally be arranged according to circumstances, but even if it takes two years for the employee working on small wages to pay for an appliance, let us see that he gets the required time; for every appliance installed in an employee's home is more than a direct revenue earner.

A census of appliances used by all customers should be taken by every electric utility organization not possessing recent information upon this subject. Costs will vary in this work, but a pretty thorough census can be taken at a cost of say 5 to 10 cents per call made by the canvasser, including office records. This cost will soon be saved in future advertising by enabling the company to circularize its territory in a discriminating way. A lot of good material is at present wasted by sending it out hit-or-miss fashion. A man who already has a modern electrically driven refrigerating plant which renders first-class service is not a natural "prospect" to circularize with refrigerator advertising, but such things often happen in an indiscriminate direct-by-mail campaign.

GIVE CREDIT TO EMPLOYEES

Credit for house wiring should be extended to employees on the most liberal terms where they are without electric service. There is little use trying to cultivate the enthusiasm of employees or customers as a class in localities where the cost of wiring is burdensome. It is not necessary to dwell upon the reward central-station companies reap from liberal policies in financing house wiring, except to point out that, apart from the effect on the public, such policies have a prominent part in solidifying the good opinion of employees concerning our service.

In the Tenney companies the interest of executives and employees has been greatly stimulated in appliance sales by the establishment of a "merchandise sales cup race" in 1920. The company which wins this cup two years in succession will receive it as a permanent trophy. The Fitchburg (Mass.) Gas & Electric Light Company won this cup in 1921, and this year interest in the contest is literally at fever heat. Along with the award of the cup goes a cash bonus, divided among sales department employees in the winning company for the year, and it is surprising how much enthusiasm for appliance sales has come out of this contest. Employees working in power plants, on pole lines, in meter departments and other branches of local company organizations are enthusiastic "boosters" for the sales record of their home utilities.

Interest in the sales cup race is maintained in the *Tenney Service Magazine* from month to month. The interest of executives is heightened by their being requested to serve on the board of judges and awards. This results in a closer contact with our sales forces and incidentally in a better understanding of the problems of sales departments and a wider familiarity with the accomplishments and possibilities of appliance service. In this connection the boards of directors of many central stations should be considered from the "prospect" angle by progressive sales departments. Even though these men are often occupied actively in many other fields than the electrical industry, they are usually proud to be associated with electric utility development and hence should logically be users of the good things which it has brought forth for the comfort and convenience of the world. In some companies it is probable that a larger percentage of outside customers than of employees are appliance users.

IMPORTANCE OF AN ATTRACTIVE STORE

A pleasant, attractive store is an essential to "selling the sales department" to our own organization in the central-station industry. Cold, unattractive offices with repellant furnishings and a hodgepodge of appliances thrown about with little regard for taste and appearance tend to neutralize the efforts of our sales forces among our own people. The central station should maintain *the* appliance store of the town. If a new office building is planned, let us tell the local public that we are going to put up a new *store* and put the soft pedal upon the office end of the transaction. The office is of little interest to the public; but if we put up a real "honest-to-goodness" store, run on pure merchandising principles, we shall find in talking and advertising that it draws a good many more people than do references to the "electric light office." Our own executives will respond to the suggestiveness of a high-grade electrical store, to say nothing of persons outside our ranks. Here we can show prospective customers the latest wrinkles in electric service, and even in small and remote towns people like to be "posted up" on the latest developments of the appliance manufacturer. We don't have to wait until a new toaster has had a year's run on Broadway before it is safe to try its appeal to the citizens of small but progressive towns in the interior of the country which are blessed with ample hydro-electric development and whose inhabitants worry less about keeping warm in the winter than some of their metropolitan brethren.

STIMULATES SALES ACTIVITIES

With our survey of the market for our service, our up-to-date electric store, our employees started on the path of using appliances in a really liberal way, intercompany competition where centralized management prevails, and, finally, with actual figures showing the increased monthly loads and revenues resulting from energetic sales policies, we can look forward to more executive support and to broader recognition of our sales organization's usefulness and opportunities among our associates.

With at least a semi-annual call by salesmen upon customers in their territories, the good fruits of the survey can be ripened into greater profits. Certainly, among such Tenney companies as those at Montpelier, Malden, Fitchburg and Exeter greatly increased activity and interest in sales work has followed the adoption of commercial policies along the lines outlined above, and others of our companies are fast falling into line in their endeavors to cultivate more intensively the fields of service open to progressive electrical merchandisers. The electrical industry has been developed for so many years upon the basis of engineering progress and interests that it is small wonder that only within recent years its leaders have begun to see the opportunities before commercial men in this remarkable branch of public service.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Laminated-Frame Arc-Welding Generators

To the Editors of the Electrical World:

In the Oct. 7 issue of your publication a letter signed Pliny P. Pipes attempts to answer the question with reference to the benefits derived from laminating the frames of arc-welding generators which was raised by the writer in the issue of the *Electrical World* for Sept. 9 last.

In the manufacturers' publications referred to in the writer's original letter the reason given for laminating the frame is that it makes the generator more responsive to external changes, thereby assisting in stabilizing the arc and making the machine easier to operate. It is very interesting to note that your recent contributor not only abandons this theory completely, but goes even further and implies that from the standpoint of stabilizing the arc the damping effect of eddy currents in a cast yoke is beneficial, although not sufficiently so to get the desired results, and the reactor must therefore be employed in the arc circuit.

While the writer does not wholly share this opinion, we obviously agree that the theory of materially stabilizing the arc, and thus making the machine easier to operate by laminating the yoke, is untenable. In view of this the statement that lamination of the frame makes it possible for the arc current to adjust itself almost instantly to any demand is meaningless. Giving due regard to the relative meaning of terms, it will be readily conceded that in a circuit containing a large amount of inductance a direct current cannot change instantly or almost instantly from one value to another, and the greater the inductance the longer will be the time required for readjustment.

We are now informed that the main advantage of a laminated frame is a reduction in the hysteresis loss and that another big advantage is a somewhat smaller reduction in the eddy-current losses. Upon closer examination there appears to be as little foundation for this assertion as there is for the theory that was originally advanced.

Your correspondent gives 0.12 as the hysteretic coefficient of cast steel, or thirty times that of sheet iron. In his "Alternating-Current Phenomena" (third edition, page 116) Steinmetz states that he has found the hysteretic coefficient of cast steel to vary from 0.0032 to 0.028, according to the chemical or physical constitution, and even in hardened steel (tungsten and manganese) he gives as the upper limit 0.08. However, whether the hysteretic coefficient of cast steel lies in a range from slightly less than to seven times that of sheet iron, as claimed by Steinmetz, or is thirty times that of sheet iron, as claimed by your correspondent, is immaterial, because in any case the loss under discussion is negligible compared with the usual unavoidable losses in the motor and generator.

The hysteresis formula given in the letter is expressed in c.g.s. units or ergs per cycle. To transform it into practical units, and expressing it in watts, we multiply by 10^{-7} and the cycles per second. The formula then becomes $W_p = \eta V B^{1.6} f \times 10^{-7}$. During the welding operation the maximum flux pulsation in the frame unquestionably takes place when the molten metal drops off, forming a momentary complete short circuit. Data taken from oscillograms and calculations show that under these conditions a pulsation of flux density in the frame of a thousand lines per square centimeter is a high estimate and takes place at not more than 15 cycles per second. The volume of the frame of the machine in question was 3,850 cu.cm., and using the improbably high hysteretic coefficient, and the hysteresis loss is

$$W_p = 0.12 \times 3{,}850 \times 1{,}000^{1.6} \times 15 \times 10^{-7} = 44 \text{ watts.}$$

The insignificance of reducing this loss to one-thirtieth or one-seventh or any other fraction is at once apparent when it is considered that the losses in the motor-generator set, when operating at 175 amp., 22 volts, probably lie in the range from 1,500 watts to 2,000 watts. An examination of the eddy-current loss shows similar results, and incidentally it may be remarked that an important factor was omitted from the formula, namely, the conductivity of the material, which is probably higher in sheet iron than is the case in cast steel.

As contrasted with this small loss, the writer has observed machines in operation in which the I^2R loss in the reactor was more than half a kilowatt when operating at 150 amp. Great as this loss is in comparison with the insignificant losses in the yoke, it is not the greatest drawback to a reactor, which is added cost. It therefore appears to the writer that the next step in the development of arc-welding generators should be so to utilize the material in the machine itself as to eliminate the reactor, thereby increasing the efficiency and reducing the cost. For designers to concentrate their immediate efforts on the solution of this problem would seem to be the logical method to pursue.

K. L. HANSEN,
Electrical Engineer.

Milwaukee, Wis.

Electric Ranges

To the Editors of the Electrical World:

In the Sept. 30 issue of the *Electrical World* "A Manufacturer" wonders why a "true electric range" is not produced instead of an electrified stove. There would seem to be no good reason why such a range could not be built.

If a new design is brought out, why stick to 110-volt heating units? Some manufacturers already provide 220-volt units if requested, and probably others would do so if the demand were sufficient.

The 220-volt range can be connected to the two outside wires of a three-wire system and a considerable saving in copper effected in the inside wiring as well as in the distribution system. A perfect balance on the three-wire system is obtained, and if the service is alternating, it is usually possible to use a smaller transformer, especially where several ranges are connected to the same secondary. The unbalance on a three-wire secondary caused by three-wire ranges is sometimes so great that a three-wire system becomes of doubtful value.

Ranges having types of units which cannot be successfully produced for 220-volt service can be balanced by the use of auto-transformer, as was described by W. C. Heston in the *Electrical World*, issue of March 11, 1922.

GEORGE M. HARDY,
General Superintendent.

Worcester Electric Light Company,
Worcester, Mass.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Radio Development Will Aid Central Stations

THAT central stations will in the comparatively near future benefit materially from developments now under way in radio apparatus for signaling by telephonic or carrier-current means was indicated in an address at the recent New London convention of the New England Division, N. E. L. A., by T. Johnson, Jr., of the General Electric Company, Schenectady, N. Y. Mr. Johnson pointed out that the use of separate antennas gives better results in radio telephony than the employment of utility distribution circuits for reception of waves by owners of modern sets for use with broadcasting station service. Broadcasting over central-station mains is as yet comparatively undeveloped. Recent carrier-current experiments have used frequencies up to 20,000 cycles, but if these are employed on circuits having gaps, secrecy is lost at the gaps.

Four carrier-current sets of the 50-watt size will soon be installed for central-station service in New England, the speaker said. Carrier-current equipment is now available for use on lines as long as 85 miles with no intervening tie-ins. Each tie-in reduces the range of transmission by about 10 miles because of reflection. Apparatus is being developed for 260-mile transmission, using a 250-watt transmitter. The same reduction in range applies to this larger work. Another forthcoming development is a concentrated condenser for transferring energy to a line with minimum loss. This will be available in about a year, according to present indications. It will probably be from eighteen to twenty-four months before portable carrier-current equipment will be available.

For straight radio telephony in central-station service with a range of 50 miles upward the antenna should be from 175 ft. to 200 ft. high and about 200 ft. long. It should be remembered that reliable service when wire lines are not available demands a very high standard of construction in the radio field. About 200 watts are required for 100-mile radio telephony, and with this amount of energy radio telegraphy can be carried 400 to 500 miles. Great advances in broadcasting equipment are to be anticipated in the next two to five years. In general, the power requirements in radio increase as the square of the distance. Present prices for carrier-current equipments range from $2,000 each for the 50-watt, 75-85 mile apparatus to $4,000 each for the 250-watt, 250-mile installations. A 200-watt straight radio telephone set for 50-100 mile central station service costs about $5,500, excluding antenna, and a 1,000-watt set $7,400. Radio can be duplexed, but carrier-current service gives better results.

Street Light Circuits to Be Controlled by Radio

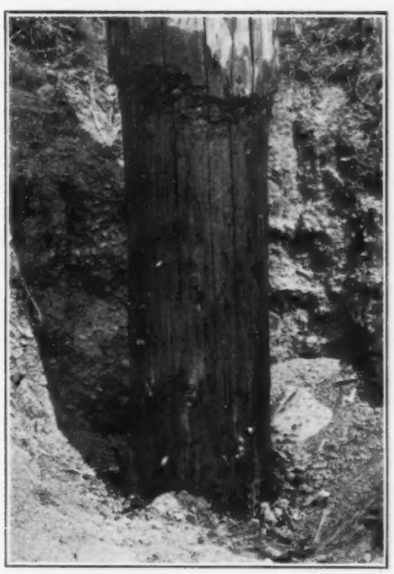
Within a year it is expected that a relay will be developed for turning on and off small-power lighting circuits in general practice. So far it appears impracticable to use carrier-current in underground cables having outside conducting sheaths. To do this on telephone lines would require loaded inductances every 1,000 ft.

Commenting upon data recently given out as to the small amount of energy required in radio broadcasting tests on the distribution circuits of central stations in Chicago and Cleveland, J. A. Vahey of the Edison Electric Illuminating Company, Boston, contended that 1 watt per square mile appears unreasonably low for such work. Recent tests at Boston between a fixed station and linemen in field service required 50 watts for broadcasting through the ether over an area with a radius of about 25 miles.

Field Editor Electrical World.
Boston, Mass.

Increasing the Life of Poles in Service

TO INCREASE the life of transmission poles which have been in service for a number of years, the Portland (Ore.) Railway, Light & Power Company follows the practice of cutting away the rot at the base of the poles and applying wood preserver. This not only gives the pole line an estimated



LIFE OF POLES TREATED IN SERVICE INCREASED FROM FIVE TO EIGHT YEARS

greater life of from five to eight years, but affords an opportunity to inspect each pole at the ground line and to replace or stub those that are badly decayed.

The method of carrying out the work is to excavate around the butt of the pole to a depth of approximately 2 ft., there being no reason to excavate any further than thoroughly to treat the portion of the pole subject to decay, which is normally 6 in. to 10 in. below the surface of the ground. An average of 1½ in. to 2½ in. of wood is cut away, or until sound wood is reached. Normally the shaving of the poles does not extend above the ground line more than 6 in. to 8 in.,

depending on how badly the sap wood is decayed. An attempt is made to taper the shaving at the ground line so that the pole presents a fairly neat appearance. This work is done during the summer months when the wood has a thorough chance to dry out before applying the preservative. A good carbolineum oil is applied cold by use of a brush. On one transmission line where 1,531 poles were treated 125 gal. of preservative was used. The unit cost per pole for material in this case was 6.93 cents, and that for labor and material was $1.31.

The increased life of the poles which will result from this treatment is, of course, problematical, but it is reasonable to expect five to eight years' longer life. After the sap wood has once decayed the heart wood takes the preservative much better than the sap wood does when treated before the pole is set. In the judgment of the engineers of this company, a mere brush treatment on new poles is of no practical value, but after the sap wood has decayed it does pay to apply a good preservative by the brush method. In all, more than 6,000 poles on the system of this company have received this treatment.

H. R. WAKEMAN,
Superintendent of Distribution.
Portland Railway, Light & Power Co.,
Portland, Ore.

Making Electrolysis Tests on Cables

WITH a reversible voltmeter, portable load box and grounding staff, tests of the potential difference between lead-covered cable sheaths and adjacent tracks, hydrants and other grounded structures can be conveniently made. After making a series of these tests preventive measures to protect cables can be taken.

Electricity Saves Expense in Oil Fields

Operation and Maintenance Costs Materially Lower than Gas-Engine Drive—Load Constant Where a Number of Wells Are Operated—Curves from Actual Operation

DRILLING is decidedly cheaper with electric drive than with gas or steam drive. In the opinion of men well versed in oil-field operation, the greatest benefit from the use of electric power is found during the flush period, when the small outage as the result of using electric power makes for greater production, and also in the low stages of production, when the low operating costs are a material influence in extending the life of the wells and therefore of the fields.

Another advantage of electric motor drive lies in the use of electrical energy in the operations of cleaning out wells and abandoning them. The lower costs of cleaning out small producers and the cheapening of the operations involved in abandonment of wells are of great advantage in facilitating production. The figures and the other data following are taken from the experience of the Empire Gas & Fuel Company in the fields at Eldorado, Kan., where electrical energy has been utilized in the drilling and operation of wells for several years to a greater extent than in any other part of the mid-continental field.

Little can be added to information already available on the costs of drilling, but a few considerations from the standpoint of the practical driller can be added. In the maintenance of electrical equipment for drilling purposes the principal attention required in the field has been found to concern the contact fingers and segments on the main controllers. These become pitted by the arcing occasioned by reversals of the motor. This difficulty does not require constant attention from an electrical man but can be handled by a regular inspector who, perhaps, visits the installation once a day. The drillers and tool dressers can, if desired, be educated to take care of the equipment so that they will be virtually independent of the need of outside assistance in making repairs.

As noted in previous articles,* the cost of electrical power is less than that of steam or gas and the saving in water required is a large item. In the case of the electric motor it is not necessary to take precautions against fire or explosion if gas is encountered as the motors used are of the induction type, a special motor to meet the requirements of drilling and pumping being put out by several of the manufacturers of electrical equipment. The motor most used for either the deep wells or those of moderate depth is a two-speed motor with a rating of 15 hp. and 30 hp. In reality it is two motors mounted in one frame, the smaller designed for pumping duty with a high all-day efficiency and power factor and the other being a hoisting motor capable of developing about five times its rated torque from standstill. All of the work about a well can be handled with this rig except drilling, for which a special 75-hp. motor is used, though some engineers favor using two of the 15-30-hp. motors for drilling in order to avoid carrying repair parts for several sizes. Use is also made in

TABLE I—COMPARATIVE PUMPING EXPENSE ON 367 WELLS PUMPED WITH GAS-ENGINE-DRIVEN UNITS AND 241 WELLS WITH MOTOR-DRIVEN UNITS

	March	April	May	June	July	Total	Cost per Well per Month
Gas-Engine Pumping							
Labor	$12,600.85	$12,431.59	$11,776.52	$10,969.85	$11,310.10	$59,088.91	$32.21
Gas	20,616.75	25,377.60	30,083.92	21,802.97	25,361.97	123,203.21	67.14
Supplies and expenses	3,151.84	2,049.66	1,821.35	2,709.65	3,104.76	12,837.26	7.00
Total lifting cost	$36,369.44	$39,818.85	$43,681.79	$35,482.47	$39,776.83	$195,129.38	$106.35
Motor Pumping							
Labor	$5,434.57	$5,039.57	$5,201.74	$5,507.11	$4,612.84	$25,795.56	$21.41
Electricity	10,301.62	9,837.54	11,232.35	10,564.76	10,591.11	52,527.38	43.59
Supplies and expenses	408.72	290.31	474.76	550.22	680.40	2,404.41	1.99
Total lifting cost	$16,144.91	$15,167.15	$16,908.85	$15,622.09	$15,884.35	$80,727.35	66.99

*A general review of electrifying oil wells, with a table comparing pumping costs with motor and gas engine drive, was published in *Electrical World* for March 5, 1921, page 533. Power requirements for drilling wells appeared May 14, 1921, page 1111.

pumping work for some parts of the field of individual motor-driven jacks equipped with a constant-speed motor of from 3 hp. to 5 hp.

Viewed from the driller's angle, there seem to be a number of decided advantages in the use of electrical energy, despite the fact that steam has in the past been viewed by him as the last word in oil-well-drilling equipment, for as a rule the driller has been a very conservative individual. The following comments taken from the report of a practical driller are especially significant: In spudding with steam it is necessary to run up against the tools hard in order to compensate for the loss of power as the engine slows under the strain. With the electric motor the pull can be made an easy and steady one, which means a saving in equipment maintenance. In bailing electric power bails faster than steam and the trouble of falling steam pressure under heavy work is avoided. Steam will start tools more quickly in pulling, but the motor gets them out of the hole faster.

TABLE II—MAINTENANCE EXPENSE FOR MOTOR DRIVE IN ELDORADO OIL FIELD ABOUT ONE-SIXTH THAT OF GAS-ENGINE DRIVE

	March	April	May	June	July	Total	Average Cost per Well per Month
Gas-Engine Pumping							
Labor	$1,947.07	$2,435.70	$2,393.12	$1,552.06	$1,446.83	$9,774.78	$5.33
Material	1,259.45	11,054.26	1,712.80	6,247.07	14,254.95	34,528.53	18.81
Total	$3,206.52	$13,489.96	$4,105.92	$7,799.13	$15,701.78	$44,303.31	24.14
Motor Pumping							
Labor	$498.02	$561.28	$415.88	$305.10	$227.18	$2,007.46	1.66
Material	311.55	292.44	1,355.17	477.71	1,156.38	3,593.25	2.98
Total	$809.57	$853.72	$1,771.05	$782.81	$1,383.56	$5,600.71	4.64

The figures available for operating costs cover only gas-engine-operated and motor-operated wells. With gas available from the wells themselves such power has been considered the superior of steam in cost. For this reason the comparisons in Tables I and II are particularly significant. The study was made over a period of five months for 367 wells equipped with gas engines and 241 wells equipped with electric motors, all in the same general territory, with conditions the same. The total lifting expense for each month and the average cost per well per month is given in Table I, while the maintenance expense of both types of equipment on the same basis is shown in Table II. In the matter of lifting motor-operated wells show an expense that is roughly two-thirds of that of the gas-engine-equipped wells. The maintenance expense for electrical equipment is roughly about one-sixth that of the gas-engine wells. In addition to the saving in expense the item of the time for shut down to make repairs is decidedly in favor of electrical operation, and the total production is greater for that reason.

Motors for oil-field service are built for handling heavy overloads for short periods and under normal conditions run at less than their rating. As might be expected, the power factor of such a load is low, while the load curve, which might be expected to be very uneven, shows a remarkably straight line. In one instance, for a period of twenty-four hours, the load varied in one substation of the Empire Gas & Fuel Company, operating in the Eldorado field, from 1,250 kw. to 1,400 kw. with very small instantaneous fluctuations.

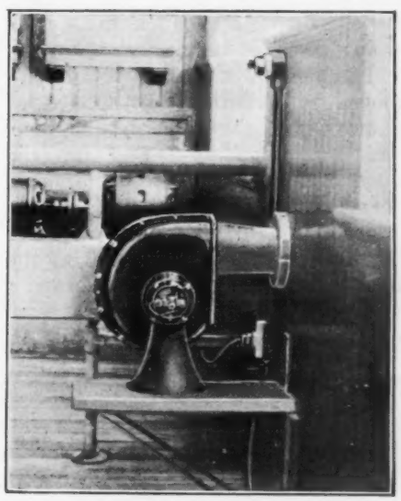
Current readings taken from the Barnhill substation, which supplies all of the operations of the company with energy in this field vary only from 220 amp. to 280 amp. over twenty-four hours. When it is realized that the number of units in use is large and the individual sizes comparatively small, the reason for the constancy of the total load is readily seen. At any one time relatively few of them are undergoing the pulling and cleaning operations that call for the full capacity of the motors. Even with a considerable number of them undergoing these operations the diversity factor is high.

The load factor of the Barnhill substation is an interesting study. Because of the pumping load this factor is very high, running in these particular cases around 80 per cent. In the particular case under observation the power supply is from the system of the Kansas Gas & Electric Company. Viewed as a central-station load proposition, there are several things to be considered. In a sparsely settled and arid territory where there is little chance of other developments the principal question at issue is the possible life of the oil field, since the failure of the field would mark the end of the business. In a territory situated in the midst of other possible developments and covered with settled communities the big question will be the fitting of the business into the development of the entire territory. In the mid-continental fields the development of service to the oil fields from the central-station lines has been slow, first, because of the difficulty encountered during the war in making any extensions, and, again, because of a doubt as to the life of the fields. Now, however, the transmission systems are being extended to cover the entire territory. The load in its general characteristics is attractive from a central-station viewpoint.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Ventilating Cells Housed in Instrument Room

IN A MASSACHUSETTS industrial plant an extensive storage battery installation occupies a portion of a room devoted to recording and indicating instruments, motor-generator sets and telephone equipment. To insure adequate removal of all gases from the cells the compact arrangement of exhaust blower and air dust shown herewith has been installed. The blower is mounted on a wooden platform supported with the aid of metal brace rods just above a stairway leading to the basement, the duct being carried between the battery boxes and the blower as shown. The equipment occupies no otherwise useful space, is accessible and insures excellent protection of sensitive relays, etc., from gases.



BATTERY VENTILATION PROTECTS SENSITIVE EQUIPMENT

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Underground Construction Above Ground

THE first step in connection with underground conduit construction is usually excavation. None the less, a short section of conduit line was recently constructed by the New York & Queens Electric Light & Power Company in Long Island City with almost no excavation, the reason being that the line of the subway extends across some low ground which is later to be filled to form a city street. The subway consists of twenty-one ducts of 4-in. fiber conduit arranged three wide by seven high with 1½-in. spacing between conduits and a 3-in. concrete envelope around the ducts.

The manholes employed at points where four conduits enter or in straightaway where only two conduits enter are built in the form of rectangles with the conduits entering at each corner. At dead-end streets or where only three duct lines enter the manholes they are constructed with one side cut off as shown in Fig. 2. These two shapes of manholes were adopted as standard for all subway construction by the company after a careful study of a large number of designs. With the minimum radius of 18 in. which has been adopted for cable bends in manholes, it was found that there was a large amount of waste in the corners of rectangular manholes and that the diamond shape with corners cut off is more economical in all cases where they can be used.

The method of construction employed in building this section of subway was to level the ground, pour the 3-in. foundation and lay the ducts one layer at a time, building up forms on the side. This is shown in Figs. 1A and 1C. The manholes were constructed by first pouring the floors and then erecting and bracing the forms above ground. A dead-end manhole is shown in Fig. 1B just before the conduit construction had been completed. The completed manhole is shown in Fig. 1D, with the exception of placing the manhole roof.

W. C. BLACKWOOD,
Electrical Engineer,
New York & Queens Electric Light & Power Co., New York, N. Y.

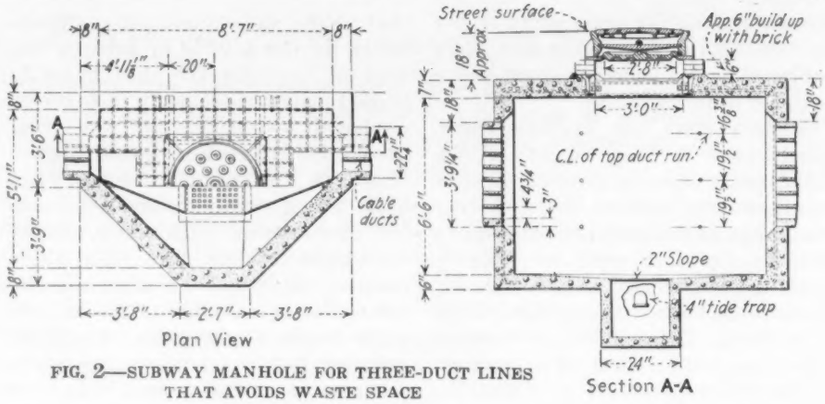
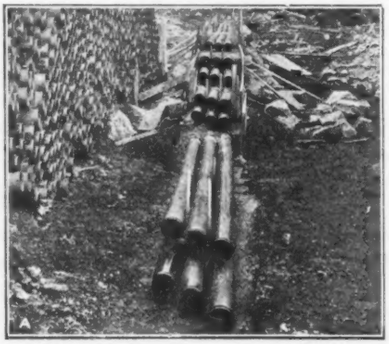
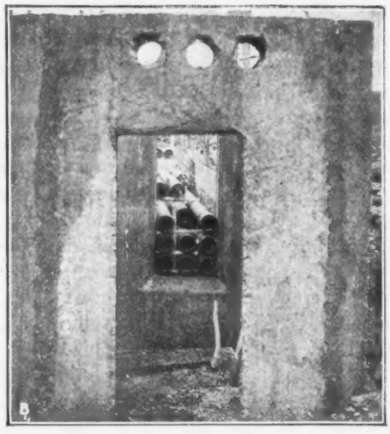


FIG. 2—SUBWAY MANHOLE FOR THREE-DUCT LINES THAT AVOIDS WASTE SPACE





Testing and Setting Relays Periodically

METHOD and care in the testing and setting of relays are of paramount importance if proper operation is to be obtained. In all cases the proper functioning of relays depends upon periodic inspection and tests. All tests should be made under conditions as nearly equal to the operating conditions as possible, according to engineers of the General Electric Company.

The determination of relay settings must receive careful consideration. An analysis of all circuit conditions is necessary, and a calculation of the short-circuit currents which may be produced at different points on the system is desirable so that selective time-current characteristic curves can be made comparative for different points of the system. The determination of short-circuit currents is most easily accomplished by use of a "calculating table," consisting of a system of adjustable rheostats which represent the impedances of the different circuits to be investigated. Connections are made to represent any system network. The short-circuit current may be read by an ammeter at any point where a short is applied.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

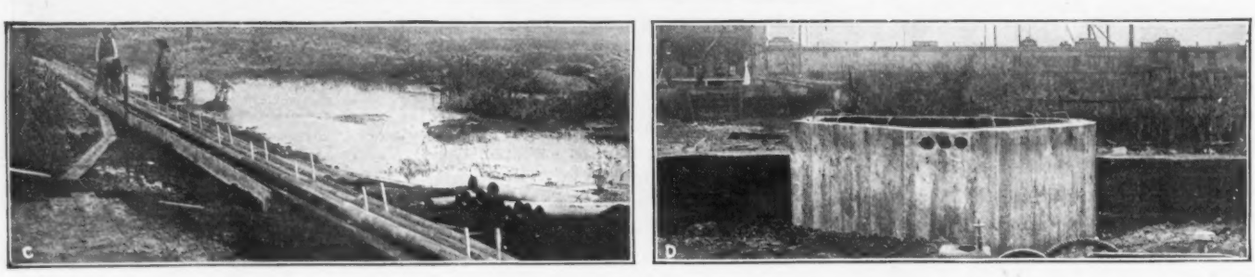


FIG. 1—SUBWAY CONSTRUCTION SIMPLIFIED WHERE LAND IS TO BE FILLED IN FOR FINAL STREET LEVEL

A—Ducts surrounded by 3 in. of concrete with 1½ in. between each conduit. B—Dead-end street manhole completed and ready for installing conduit. C—Conduits laid and ready for pouring concrete. D—Completed subway without manhole cover.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Banker's Appraisal of Utility Securities*

Effect of Customer Ownership in Marketing Senior Issues —Need of More Detailed Reports— Outlook for the Future

By John A. Prescott
Chairman of Committee of Public Service Securities, Investment Bankers' Association of America

During the last two years there has been marked improvement in the demand for public utility securities, which, coupled with declining interest rates, has resulted in a broader market and higher prices. This has affected not only senior issues, like funded obligations, but also junior issues even to some of the more speculative classes. Mortgage bonds, and even preferred stocks, of the best-established companies can now be sold with comparative facility, although in case of preferred stocks still at relatively high cost. With very few exceptions, however, common stocks are difficult, if not impossible, to market. Thus the financial problem is still the overshadowing one.

Capital for Common Stock

As was indicated in a previous report, we believe a much larger proportion of capital than has been the practice in recent years should, to accord with sound principles, be hereafter supplied by junior financing. It is very generally understood that if mortgage bonds are to be readily sold, they must be protected not only by a sufficient equity or margin of security, but also by a satisfactory margin of divisible income. It is not so well understood, by the public at least, that if a preferred stock is to be readily sold, it also must have behind it a margin of security and of income adequate to give it a high degree of safety and reasonable assurance of continuity of dividends.

Capital for the final equity or common stock should be obtained primarily from the people of the community which is to enjoy the service, but if conditions should be such that it cannot be obtained from them, it must be sought in other money markets. Investors in such markets can receive no direct benefit from the development of the utility service itself and must, therefore, be attracted by safeguards to their investment and yields such as will seem attractive to their eyes, as compared with other similar investment opportunities.

Protection of the security and income of the capital invested in the final equities, or common stocks, of public utilities evidently must be, as it should be, the fundamental factor in the development of public utility service. Where such conditions have existed and companies have, therefore, been able to build up sound financial structures, investment bankers have felt safe in supplying common stock capital. As such protection and conditions become more widespread new sources of such capital will be found and drawn upon by investment bankers, and customer ownership will become increasingly common.

An increased confidence of investors in public utility securities will accrue from the dissemination of more complete and comprehensive information concerning the economies of the public utility business. A careful study of annual reports, circulars and statistical manuals disclosed a marked improvement in recent years in this direction. We believe that co-operative effort on the part of the industry, investment bankers and publishers of statistical and rating manuals will bring about still further improvement. Additional data are really available because many states require the filing of complete operating and statistical reports. These data require only to be made more accessible.

Perhaps the greatest need for more complete information is with regard to so-called holding companies. These are often very large and their relations with their operating companies are sometimes complex. Full information necessary to a complete disclosure of their financial condition often would be detailed and voluminous, but the fact that such information is furnished by some of them indicates, in the opinion of your committee, that there are no serious obstacles to its disclosure by all. We believe that any such company which seeks capital from the investing public should make available and readily accessible all information and data pertaining to both the holding company and subsidiaries necessary for a thorough study of earnings, expenses, maintenance expenditures or reserves, fixed charges, dividends, assets, capitalization and liabilities. Without these an appraisal of the real worth of its securities would not be possible.

Public Utility Bonds as Legal Investments

Public utility bonds are already legal investments for savings and trust funds in twelve states. For some time it has been felt generally that savings banks in other states should logically be extended the privilege of purchasing gilt-edged utility bonds, which are generally conceded to constitute one of the safest classes of investment securities and which yield on an average a somewhat higher rate of return than legal rails.

A joint committee of the National Conference of Mutual Savings Banks and the National Electric Light Association was appointed last December to consider this question. A member of our committee is serving on that joint committee and it is hoped that substantial progress will be made during the coming winter.

It would be strange indeed if the public utility industry, unlike all other forms of business enterprise, should have emerged from the upheavals of the great war with no changes in the conditions of its existence, no new problems to confront

*From a report relating to utility securities presented at the annual meeting of the Investment Bankers' Association of America, Del Monte, Cal., Oct. 10, 1922.

it. Like others, it was obliged to meet higher operating costs and heavier taxes with reduced income.

On the other hand, adverse and discouraging conditions are being overcome by favorable and encouraging ones. Costs have declined considerably, and gradually improving general business conditions are bringing some increases in earnings. The practical experiences and lessons of the war and its aftermath seem to have done much to clear the atmosphere and bring about a more widespread popular understanding of the economic and financial conditions under which efficient and satisfactory service, keeping pace with public demand, alone is possible.

The present practice of many utility managements of frankly discussing the problems of the industry with their patrons is stimulating public confidence and good will. There is a growing recognition of the real mutuality of interest between the companies and their patrons. To paraphrase a recent statement of the president of one of our most successful companies:

1. The customer's attitude toward a public utility can now be guided and made informed and friendly.

2. Satisfied customers now can be used to build up good will.

3. Pleased customers will voluntarily help a utility to get new business.

This better mutual understanding already has enabled the managements to eliminate much useless expense and many artificial obstructions to efficient operation and has also removed much of the uninformed popular objection to adequate rates. It certainly will bring many other practical and profitable results, including improved credit. Investment bankers will naturally give great weight to such favorable conditions in considering public utility financing.

UTILITY BUSINESS FUNDAMENTALLY SOUND

This committee has faith in the fundamental soundness of the public utility business, including gas and transportation as well as power and light. There is an insistent and, we believe, permanent demand for the services it renders. We expect that public utility credit will be soon established upon a basis of greater permanency and stability than ever before. As in other industries, there will be exceptional situations; and discrimination and sound judgment will be required. But the solution of the impending financial problems of the public utility companies will, in our opinion, afford investment bankers opportunities for both constructive public service and profit, and will demand the assumption of duties and responsibilties from which they should not shrink.

Benefits of Consolidation of Central Stations

A GOOD example of the economies to be effected through tying together a number of small and medium-size central stations is seen in the recent consolidation of several Wisconsin utilities and one Michigan utility into the Wisconsin Public Service Corporation. Although the plan has been under tentative consideration since 1912, because of unfavorable financial conditions it was not deemed advisable to consolidate the companies until the present time.

TERRITORY SERVED BY WISCONSIN PUBLIC SERVICE CORPORATION

The physical property of the company includes five electric generating plants with an aggregate installed normal capacity of 28,600 kw., of which 12,000 kw. is hydro-electric; twenty-three substations with a transformer capacity of over 52,890 kw.; 349 miles of three-phase, high-tension transmission lines, and adequate distribution lines.

The company's field of operation, as shown in the accompanying map, embraces eleven counties of northeastern Wisconsin and one county in Michigan. The territory includes the Fox River Valley, one of the most prosperous and populous farming and manufacturing districts of Wisconsin, as well as several important communities along the western shore of Lake Michigan.

Of the advantages realized by bringing these various companies under one operating and financial head, Clement C. Smith, president of the Wisconsin Public Service Corporation, says:

"We expect by this consolidation to give coherence and added strength to the company, to extend further its field of business, reduce expenses and make its securities stronger and more desirable to the public and investor. The company gains a great diversity of business, tying together three large water powers and two steam stations. We now have under construction a fourth hydro-electric plant and may follow this with another.

"The interconnection of the several water power and steam stations by transmission lines will result in a very considerable improvement of load factor and the distribution of power. It will also be possible to effect many distinct economies in the management and operation of the property."

Value of Purchase Organizations Emphasized

EARLY anxieties as to the results of forming an association of utility and other purchasing agents in New England have been dissipated by experience, according to a report made by H. L. Ogden before the New England Division of the N. E. L. A. at its recent New London convention. Public utilities now operate a Purchase Information Bureau at 77 Franklin Street, Boston, under the direction of Mr. Ogden, and the first year's service of the bureau was recently completed. Thirty-five companies are members.

Weekly bulletins are issued giving information regarding prices and conditions of the coal and coke markets, copper market, fuel and gas oils, cement, iron and steel, cast-iron pipe and railroad conditions, supplemented from time to time by prices on pole-line hardware, automobile tires, etc. Quotations are also obtained on other materials or apparatus in which the members are interested. The conservatism of the purchasing agent as a class has rendered this development rather slow, but there is now a New England

branch of the National Association of Purchasing Agents, with a regional membership of about 350. Contrary to early fears, the association has been welcomed by the manufacturers and is working in harmony with them on matters of importance to the business interests of the country.

During the first six months of the operation of the Purchase Information Bureau the members were saved between $5,000 and $6,000. This was ascertained in order to determine whether the bureau should be continued, and since that time no effort has been made to keep or obtain such records. Letters received by the bureau testify as to specific savings, through being put in touch with vendors quoting the right price, in checking prices, in stabilizing quotations from jobbers and in the use of bulletin data as permanent records for stock and rate hearings. The bulletin has also put buyers in contact with firms whose facilities were formerly unrealized and has guided purchasers in placing orders in advance of actual needs.

Alabama Power Launches National Publicity

THE Alabama Power Company, which is this month celebrating its tenth anniversary, has started a campaign of national aspect to advertise the industrial advantages and development of the South. An interesting program of publicity has been announced by Thomas W. Martin, president of the company.

Moving pictures are being taken of Alabama industries which will be shown not only in the theaters and schools of that state but throughout the Union. Three films have already been completed and two more, devoted exclusively to the exposition of the industries served by the Alabama Power Company, are being made. There are fifteen classes and 160 major industries served by the company.

Full-page advertisements are being run in some of the leading popular publications of the country detailing the advantages which Alabama offers to manufacturers, in line with the statement of Roger Babson that "Alabama is destined to become a leading industrial state."

A promotion department is also maintained by the company which devotes its time to inducing new industries to locate in those sections of Alabama served by it. Recently representatives of the company went to New England, where they conferred with some of the largest textile interests, telling of Alabama's plentiful and cheap labor, climate as affecting living conditions, superior transportation facilities and abundant hydro-electric power.

Making Every Employee a Personality to the Public

BY AL C. JOY
San Joaquin Light & Power Corporation, Fresno, Cal.

TO DISPROVE the charge that the company has no personality, the San Joaquin Light & Power Corporation is following the practice of many hotels in placing the name of the clerk on duty where it may be seen by guests. On every desk in the company offices is placed the name of the man to whom it belongs, so that there will be no question in a customer's mind about the employee's name with whom business was transacted, and he thus becomes not merely a clerk or an official, but "Mr. Jones" or "Mr. Smith," to the customer. This idea is being carried to every department of the company. The accompanying cut shows how the names of the men on duty at the Kerckhoff power house are indicated at the entrance to the plant. At other stations and substations similar racks are used.

HOW NAMES OF MEN ON DUTY AT POWER PLANT ARE DISPLAYED

On auto trucks the names appear on a brass plate near the driver's seat. Elsewhere the names are printed on cardboard and slipped into a frame so that they may be interchanged when changes are made.

This practice has accomplished two definite things. It has created better relations with the public through giving a personal touch to contacts between employees and customers and it has accorded a greater dignity to the individual employee within the organization.

What Other Companies Are Doing

Cleveland, Ohio.—This city's fifth electrical home, which has just been completed, was sold for $45,000 cash before it was thrown open to the public. The new owner will occupy the home upon the close of the display, Nov. 1. The salability of the electrical homes in Cleveland is an interesting indication of the public's appreciation of the value of the convenience afforded.

New Orleans, La.—Following the plan of familiarizing themselves with all branches of the electrical industry, the members of the Electric League of New Orleans, as guests of Barton T. Baird, district manager of the Cumberland Telephone & Telegraph Company, held their October meeting at the company's headquarters. A tour of inspection of the plant was made and a demonstration of the switchboard and main exchange was given. Dinner was served in the company's dining room, and following this the regular session, which was designated as "manufacturers' night," was given over to talks by several of the leading electrical manufacturers.

Chicago, Ill.—New power business contracted for by the Public Service Company of Northern Illinois between Jan. 1 and Sept. 9 this year totals 16,122 hp. This is 5,000 hp. in excess of the same period in 1921. Electric range sales during the first eight months of 1922 were greater in number than those made during each of the years 1920 and 1921. The total number of houses wired from Jan. 1 to Sept. 2 was 572. Independent contractors wired 1,340 houses during this period, making a total of 1,912, nearly four times as many as were wired during the same period in 1921 and exceeding the number wired in 1920.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Evaporators in the Stationary Power Plant.—After a short review of elementary principles, this article takes up the high-pressure and low-pressure systems of evaporators, describing the apparatus and showing how the lay-out is determined by the heat balance of the particular plant. Attention is called to the fact that both low-pressure and high-pressure evaporators when properly fitted into the station heat balance return to the feed water most of the heat in the steam supplied to them, so that the selection must be made largely on the basis of first cost, reliability and labor required, giving due weight to blow-down and radiation losses.—*Power*, Sept. 19, 1922.

Hydro-Electric Plant at Goesgen, Switzerland.—The erection of an adjustable dam 90 m. wide across the River Aar, a canal 4.8 km. wide above the power house and a tailrace 1.4 km. in extent provided an average head of 15 m. at a maximum of 350 cu.m. of water per second for this modern station. Six turbines of 10,000 hp. maximum output each are now installed, with room for a seventh unit. These wheels are vertical-shaft units of the Francis type, with a speed of 83 r.p.m. to 93 r.p.m. According to the existing load conditions the best efficiency of these turbines is at 6,500 hp., when it is 85 per cent. The three-phase alternators have a continuous rating of 7,050 kva. at 70 per cent power factor and are wound for 7,700 volts to 8,400 volts. Four of the machines are designed for 50 cycles (83.3 r.p.m. and seventy-two poles) and the other two for 40 cycles (75 r.p.m. and sixty-four poles). Provisions are made to operate any generator at either of these two frequencies. Their efficiencies at unity power factor are about 95 per cent for loads between 5,000 kva. and 9,000 kva. An oil-pressure-operated brake is provided to stop the units quickly after shutdown. A 145-kw., 250-volt exciter with ten main poles and ten commutating poles is connected to the shaft directly above the thrust bearing. An interesting detail of these large machines is the fact that they are mounted about 5 ft. above the main floor on a number of heavy pedestals. This gives excellent ventilation for the machines and makes the regulating apparatus easily accessible. Seven forced-oil-cooled three-phase, 7,050-kw. transformers are installed in the switching building. Four of these transformers step up to 50,000 volts and three of them to 77,370 volts. The latter transformers have taps to deliver 50,000 volts in case of emergency. A double set of buses is provided for both the low (8,000) and the high (50,000 and 77,370) voltages of the station. The transformers, the buses, the switches and the protective apparatus are all installed under the roof in a spacious switch house. The erection of this important Swiss generating station entailed a large amount of difficult but very efficiently handled hydraulic building work, which is described and illustrated to the smallest detail in this elaborate book of fifty-seven pages with 138 illustrations.—*"L'Usine Hydro-Electrique de Goesgen" (published by the Motor Société Anonyme pour les Application de l'Electricité, in Baden, Switzerland).*

Generation, Control and Switching

Fuel Saving.—R. BOSSELMANN.—A statistical survey of a great number of German isolated steam-power plants disclosed the fact that the average station operates at only about 20 per cent of its capacity, a low load factor which is responsible for a very high coal consumption per generated kilowatt-hour. Of the 2,500 plants investigated the overwhelming majority are direct-current systems. The author suggests changing these highly wasteful stations into substations, connecting them to high-tension trunk lines, and installing automatically operating rotary converters which can feed the local networks in conjunction with a storage battery. A specially designed contact-making wattmeter will start and stop the units without manual help, according to the demand. It is claimed that this method will elevate the load factor to some 66 per cent to 75 per cent and will result in a great saving of fuel. A projected change of such an isolated plant is described with all details considered.—*Elektrische Kraftbetriebe und Bahnen*, Sept. 10, 1922.

Transmission, Substations and Distribution

Economy in Substation Construction.—W. J. HOWARD.—A number of substations of very simple construction have been built by the Sheffield Corporation, England. Each accommodates two 1,000-kva. transformers, 11,200/2,030 volts, together with two 200-kva. transformers, 2,000/205 volts. Protective arrangements, building construction, ventilation, etc., are considered.—*Electrician*, Sept. 15, 1922.

Transmission Line of 120,000 Volts.—E. DUVAL and S. BOUKSPOUN.—Running from the 28,000-kw. hydro-electric power station at Basse-Isère two double three-phase transmission lines have recently been finished, operating at 120,000 volts. One line to Saint-Etienne is 42 miles long, the second to Saint-Chamond is 50 miles long. The design of the lines is such as to permit later an increase of the voltage to 150,000. Steel-aluminum cables were made use of throughout, with diameters of 13 mm. and 16 mm. respectively for the two lines. The larger cable for the second line was chosen on account of more severe climatic conditions of that right-of-way. Chains of six to eight Hewlett disks support the conductors and are used as double chains at crossings of road or other lines. Square-base steel towers with a frame-like top of three different types have been employed along the lines. The three conductors of each of the two double lines are carried on separate towers, so that the two are fully independent of each other.—*Revue Générale de l'Electricité*, Sept. 16, 1922.

Units, Measurements and Instruments

Oil-Testing Methods.—H. STAGER.—The author reviews the general properties of oils and gives a detailed description of different oil-testing methods, with the shortcomings of each. A method is then described which, the author claims, imitates as closely as possible actual service conditions. Aside from the proper amount of oxidation of the oil, the influence of copper upon it and its discoloration, a new feature is introduced by testing the mechanical strength of a sample piece of cotton, such as is used to insulate the windings of a transformer, before and after the influence of the acids in the oil upon it. The very complex nature of oil makes it necessary to investigate its behavior under a great variety of conditions to obtain a valuable and not too single-sided result.—*Brown-Boveri Mitteilungen*, August, 1922.

Chrono-Photographic Method of Measuring the Speed of Water Flow on Dams.—P. MORIN.—An interesting and simple method is described to measure the speed and acceleration of the flow of water. The speed of the revolving shutter of a camera is adjusted so as to produce streaks from a floating glass ball. The lengths of these streaks, measured against a simultaneously photographed scale, give an exact measure of the speed of the waterflow at every point within the field of the lens.—*Revue Générale de l'Electricité*, Sept. 23, 1922.

Relation Between Magnetic Hysteresis Loss and Coercivity.—N. L. ANDERSON and T. M. C. LANCE.—The principle presented is that the specific hysteresis loss is a function of the product of the coercivity and the maximum induction density. The value of the function is determined for different magnetic materials, and a general law deduced.—*Engineering*, Sept. 22, 1922.

The Regular Icosahedron as a Substitute for the Ulbright Sphere.—K. S. WEAVER and B. E. SHACKELFORD.—Owing to the difficulty of constructing large true spheres and to the limited head room usually available, a regular

icosahedron has been selected as being most suitable for photometer work. The value of this shape was determined by means of experiments on a 30-in. model. As a result a 10-ft. icosahedron has been constructed for testing the largest street-lighting fixtures.—*I. E. S. paper, Swampscott, Mass.*, Sept. 25-28, 1922.

Illumination

Restoration of Burned-Out Incandescent Lamps.—H. LUX.—The article gives a review of the many possible methods of renewing the broken or burned-out filaments of incandescent lamps. Four main methods for such renewals are known: (1) The glass bulb may be made with a joint in the first place; (2) the bulb may be opened at the exhaustion tip; (3) same as in (2), but additional openings are made near the base of the lamp; (4) the bulb is cut open along the base and afterward resealed. The fourth method is being used to some extent in England and Germany, where the present high cost of new lamps makes the renewing of old lamps a commercial success.—*Zeitschrift für Beleuchtungswesen*, Aug. 14 and 31, 1922.

Motors and Control

Electric Drive in a Beet-Sugar Factory.—A. J. FORBESS.—The advantages and disadvantages of electric drive as compared with steam-engine drive are discussed from the standpoint of the operator and manager. A beet-sugar factory operates but one-third of the year, and the operating power is in the nature of a by-product, so that the higher power efficiency claimed for electric drive is not a deciding factor. It is shown, however, that properly applied electric motors give greater continuity of service, lower cost of operation, etc., than the steam engine.—*General Electric Review*, August, 1922.

Electric Blooming-Mill Drive.—S. N. ROBERTS.—As the subject of electric blooming-mill drive is very wide, the author confines himself to a specific example in which he gives a description of a particular drive with its special features, mentioning such operations and advantages as might apply to any blooming mill.—*Electric Journal*, September, 1922.

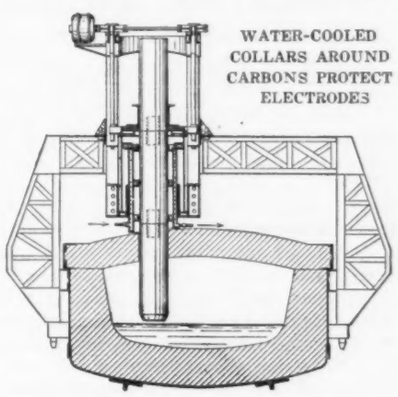
Electric Motors for Driving Pumps —R. A. JONES.—The author treats of the characteristics of reciprocating, rotary and centrifugal types of pumps, direct-current and alternating-current motors, speed control of motors and motor controllers.—*Power*, Sept. 5, 1922.

The Application of Electricity in the Manufacturing Industry.—In the manufacture of cement from its raw materials a variety of crushing and grinding operations are involved which readily lend themselves to the adoption of electric power. The severe conditions met with in crushing, grinding and calcining of the raw materials require that the electrical apparatus be of very rugged construction. The adoption of the synchronous motor and the magnetic clutch is described.—*Electrical News*, Sept. 1, 1922.

Troubles in Direct-Current Armatures.—MARIN PHILLIPS.—Much labor may be saved when winding armatures if coils are tested as they are placed in the slots. If trouble is found, it will be much easier to make repairs at this time than to make them after the job has been finished. The author points out the tests to make and gives some practical hints on correct methods of winding and connecting the coils so as to prevent trouble in the first place, with details of how to remedy defects which may develop.—*Industrial Engineer*, September, 1922.

Heat Applications and Material Handling

Electric Steel Furnace.—G. VITALI.—The Italian "Fiat" works have had such excellent results with their six 5-ton electric steel furnaces for the last few years that their new steel plant was equipped with four 20-ton and two 6-ton electric furnaces, to which eight



more will soon be added. These latest three-phase steel furnaces have a number of unusual features, among which are a marked reduction of the electrode consumption, an easy and independent electrode removal and unusually low current requirement. Two concentric airtight and water-cooled collars around each of the three carbons prevent the flames from consuming the electrodes. Only the extreme end of each electrode is subjected to oxidation. As a rule, 8 kg. to 15 kg. of graphite electrodes were consumed in older types of furnaces, while the new model needs only 2.8 kg. per ton of melted steel. Each furnace is fed from a three-phase transformer, which delivers 130 volts and 2,000 kva. at the start, connected in Y, and 75 volts and 1,150 kva. during the refining period, when it is delta-connected. An average consumption of 0.7 kw.-hr. per ton has been established, after the production of about 1,250,000 kg. of steel. This figure comprises all transformer losses and also the heating of the furnaces during holidays.—*Electrotechnische Zeitschrift*, Sept. 21, 1922.

Traction

Using Direct Suspension Trolley in High-Speed Train Service.—CLIFFORD HUTTLESTON.—A change from a rather infrequent service employing single 30-ton wooden cars operating at a schedule speed of 15 miles per hour to a frequent service using from one to six steel 50-ton cars per train operated at an average schedule speed of 47 miles per hour and a maximum of 70 miles per hour, without any material changes in the overhead construction, is what has actually taken place on the Chicago, North Shore & Milwaukee Railroad. The difficulties that were met and the manner in which they were worked out are related.—*Electric Railway Journal*, Sept. 23, 1922.

Steel-Mill Yard Electrification.—DAVID C. HERSHBERGER. — Electric power is already extensively employed for certain classes of transportation work in and about steel mills with marked success. The installation of electric locomotives to perform the yard transportation system service is an important step toward the perfection of the operation of the steel plant as a whole. The subjects covering electrification considered in this paper are: System of electrification to be used, connection to adjoining railroads, operating conditions, locomotive design and control equipment, and conducting systems most applicable.—*Electric Journal*, September, 1922.

Electrophysics, Electrochemistry and Batteries

Electrolytic Zinc Works in Tasmania. —A description of the largest zinc-producing plant in the world at Risdon, Tasmania. The plant is able to produce 30,000 lb. of zinc in twenty-four hours. The rotary-converter equipment for furnishing the low-voltage energy for the electrolytic process is described in detail.—*Engineer*, Sept. 22, 1922.

Preparation of Perchlorates by Heating Chlorates.—FRANK C. MATHERS and J. W. H. ALDRED. — Possible uses for perchloric acids for preparing electroplating baths, especially for lead, make a cheap source of perchloric acid desirable, and results of experiments seeking to increase the yield by heating chlorate under various conditions are given.—*American Electrochemical Society paper, Montreal*, Sept. 21, 1922.

Telegraphy, Telephony, Radio and Signals

Radio References and Classifications. —References to papers in current periodicals which are of interest to radio engineers and scientists for the month of August. The list includes practically all the literature on radio communication principles, measurements, standardization, apparatus, systems, applications, stations and radio manufacturing.—*Pamphlet of the Radio Laboratory of the Bureau of Standards.*

Printing-Telegraph Machine.—A description is given of a new machine telegraph that employs a five-letter alphabet, operates on the closed-circuit plan and is a seven-unit system. The printer is a combination of the Hughes and Baudot, and the transmitting speed obtainable is forty words a minute. Full details of the apparatus employed have been included in the description.—*Electrician*, Sept. 8, 1922.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

A. I. E. E. 1923 Meetings

New York, Swampscott, Pittsburgh and San Francisco Selected for National Gatherings

IN ACCORDANCE with its policy of holding four national meetings each year, the American Institute of Electrical Engineers has taken steps to arrange its program for the coming twelve months. The board of directors has approved the holding of two meetings, the midwinter convention in New York on Feb. 14 to 16 and the summer convention at Swampscott, Mass., on June 26 to 29. At a recent meeting of the meetings and papers committee it was recommended that one of the other conventions be held in Pittsburgh in April and the other one at San Francisco in the latter part of September or October. With four conventions distributed about the country, each member of the Institute, it is held, should be able to attend at least one national meeting.

Surplus Power from Paper Mills to Be Marketed

Organization is announced of a company to be known as the Power Corporation of New York with the object of developing water power for the use of paper mills, the surplus horsepower to be sold for general power purposes. The new company, which is backed by interests affiliated with the Northern New York Utilities, Inc., and the Northern New York Trust Company, has a capital of $1,000,000 preferred and 300,000 shares of no-par-value common stock and is authorized to issue $5,000,000 in bonds. It has acquired by purchase from the St. Regis Paper Company and the Hanna Paper Corporation the water powers at the six mills of these companies, developing some 38,000 hp. These power sites are at Deferiet, Herrings, Norwood, East Norfolk, Norfolk and Raymondville.

In addition, the Power Corporation of New York has acquired water powers on the Racquette River, near the power properties of the Aluminum Company of America, capable of developing an additional 60,000 hp. This is said to be the largest aggregate of hydraulic power in New York State and the East, with the exception of the Niagara Falls development.

The president of the new power corporation is John N. Carlisle, president of the Northern New York Utilities, Inc., and formerly State Highway Commissioner. Most of the directors are identified with the paper-mill industry in northern New York.

It is reported in this connection that the 25,000 hp. of electrical energy being generated by the Northern New York Utilities, Inc., at Brown's Falls, N. Y., is to be sold to the Utica Gas & Electric Company and will be transmitted over power lines now under construction from the power site in St. Lawrence County.

Important Patent Suits Come Before Supreme Court

The United States Supreme Court has granted a writ of certiorari in the case of the Webster Electric Company against the Splitdorf Electric Company and will hear argument in this case, which, it is said, will invalidate thousands of patents if the decision of the lower court stands. The case involves a charge of infringement of patent of the Kane oscillating magneto ignition equipment used on gasoline engines. The defense was that the device had been in use two years before application for a patent was made. The trial court held that there had been infringement, but the Circuit Court of Appeals reversed this decision.

Appeal by certiorari has been denied by the Supreme Court in the case of the Whiting Manufacturing Company against the Alvin Silver Company, another patent case. While the suit arose over a design for spoons, the principle declared by the trial court that the complete design must be registered was considered so important that a number of electrical equipment companies and other manufacturers intervened in asking review by the Supreme Court.

I. E. C. Will Meet in Geneva on Nov. 18

A meeting of the International Electrotechnical Commission will be held in Geneva, Switzerland, starting Nov. 18, to consider principally questions of rating, but also symbols, nomenclature, high-voltage standards and possibly the international situation on lamp sockets.

The United States will be represented by C. O. Mailloux, Clayton H. Sharp, H. M. Hobart, C. E. Skinner and two or three others. Messrs. Skinner and Sharp, accompanied by their wives, sail on Nov. 1 on the President Adams. Sailing dates of the others and the complete membership of the committee are not known as *Electrical World* goes to press.

Bars Power Line from Road

Nebraska Supreme Court Forbids a 13,200-Volt Circuit Because of Inductive Interference

A DECISION of the Nebraska Supreme Court handed down this month bars a 13,200-volt circuit from a portion of the Lincoln Highway on the ground that such a circuit will seriously interfere with the automatic signal system of the Union Pacific Railroad. The case arose originally through the activities of a firm of contractors which has been engaged in working up the construction of lines from neighboring transmission systems to small plants, largely municipal, thus bringing about the shutting down of these inefficient generating stations. In the case involved a line was to be constructed to serve the towns of Maxwell and Brady. The available route lay along the Lincoln Highway, for some distance adjoining the right-of-way of the Union Pacific Railroad. When the case came before the State Railway Commission of Nebraska evidence was submitted to show that such a parallel is dangerous to automatic block signals. So far as the record in the case indicates, no experienced witnesses appeared to give testimony counteracting that for the railroad, and on the showing of fact the commission refused permission to the contractors to build the line.

The case was taken to the Supreme Court on the plea that the commission, under the law, lacked authority to bar such lines from the highway and could only specify the construction and location to protect other utilities on or near the same highway. The Supreme Court dismissed the appeal without opinion, thus upholding the right of the commission to bar such lines from the highway if in its judgment they cannot be constructed and operated to avoid imperiling the service of other utilities.

Rehearing in Kahlotus Interference Case

The Supreme Court of the State of Washington has granted a rehearing on the petition of Receiver A. F. Phillipay of the Connell-Kahlotus Telephone Company. This is the case in which it was held that the Pacific Power & Light Company was not responsible for the cost of metallicizing telephone circuits and taking other measures to prevent troubles due to induction. It was shown that the power

company had used every precaution in the construction of its own lines and that the telephone lines were not in good physical condition.

In the petition for rehearing the receiver claims that the decision sets up as law the assumption that an owner must preserve and guard his own premises from injuries caused by the wrongful acts of another. He contends that "allowing the power company to erect its power line and release its destructive influence within such close proximity to the plaintiff's established line is in violation of the constitution of the State of Washington," which declares that "no private property shall be taken or damaged for public or private use without just compensation having first been made." It is further claimed in the petition that there was no reason for the power company constructing its line in close proximity to the telephone line, and that the power company having elected to do so thereby became liable for the resulting damages. The case has been set for argument on Dec. 11 next.

International Power Plan

License Sought from Federal Board for Dam in Rio Grande to Serve Laredo, Mexico

THE first power project affecting the international boundary between the United States and Mexico which has come before the Federal Power Commission is that covered by an application of R. W. Morrison of St. Louis. It involves the erection of a power dam 30 ft. high in the Rio Grande 10 miles above Laredo, Tex. No public lands are involved, but Congress has declared on various occasions that the Rio Grande is to be regarded as navigable as far up as El Paso. The commission cannot, of course, authorize the construction of that part of the project located in Mexican territory but it is understood that the necessary permission already has been obtained from the Mexican government. It is the intention to install equipment capable of generating 5,000 hp. to supplement the 5,000-hp. steam plant which now is furnishing the electricity used in Laredo.

OTHER PROJECTS BEFORE BOARD

The Idaho Power Company has applied to the Federal Power Commission for a license covering a 44,000-volt transmission line from American Falls to Pocatello, Idaho. This line will connect the Idaho Power Company's system with that of the Utah Power & Light Company. The Idaho company has a large pumping load which during two months of the year reaches a high peak, and the interconnection will permit much more economical handling.

Anna P. Gray of Pueblo, Col., has applied to the commission for a preliminary permit covering three small projects at the headwaters of South Colony Creek in Custer County, Col. The primary power available is 1,080 hp. It is to be used for mining purposes.

The Home Power Company of Skagway, Alaska, has applied for a permit for a small project on Blank Creek just above the town of Skagway. The power is intended for public utility purposes.

Utility Control in Indiana

State-Wide Poll Shows Great Majority of Business Men in Favor of State Regulation

FIRST returns from a state-wide poll in Indiana on the subject of governmental regulation of public utilities show conclusively that the business interests of the state are overwhelmingly in favor of regulation of some sort. Those polled were the members of the Indiana State Chamber of Commerce, the Indiana Manufacturers' Association and the Indiana Bankers' Association. The returns show a vote of 614 to 48 in favor of regulation of public utilities. On the question whether the utilities should be regulated by the state the vote was 587 to 77.

Another question, "Should the state regulate even those utilities operating only in one city?" the vote was 589 to 88 in favor of regulation. The vote showed 604 to 52 in favor of keeping all regulation out of politics. When these returns were made public only about 30 per cent of those asked had yet voted, but the preponderance of sentiment was clear.

Just what attitude the cities now opposing state regulation will take in face of the poll is problematical, though city officials have organized an association whose main purpose is to introduce legislation inimical to the Public Service Commission at the coming session of the Legislature. The Mayor of Indianapolis has not been so active in opposition of late.

Miller Ranks Water Power Above Navigation

Governor Miller of New York continues to assail the St. Lawrence River development project as chimerical and has not hesitated to attack it even in the northern counties of the state, where it has the strongest support.

"The sooner our people get out of their heads this wild dream that it will be possible for ocean ships to ply back and forth between the Great Lakes and the Atlantic through a St. Lawrence Canal, the better," he is quoted as saying. "Of two related projects now under consideration — navigation and water power—the latter is far away and fundamentally the more important. The development of water power means that all of our people will be able to get the essential comforts and conveniences much cheaper than at present. It means that the cost of living will really come down. It means that before long we should have 1,000,000 hp. from the interior streams and 1,000,000 hp. from the St. Lawrence, or the equivalent of 20,000,000 tons of coal."

Importance of Publicity

West Virginia Utility Men, Meeting at Charleston, Plan to Promote It

AT THE annual convention of the Public Utilities Association of West Virginia, held at Charleston on Oct. 20 and 21, plans were made for a publicity campaign in the state to educate the public concerning the utilities. M. H. Aylesworth, executive manager of the National Electric Light Association, told of the advertising campaign launched by the body he represents.

Former Governor W. A. MacCorkle was toastmaster at a dinner given the delegates at the Kanawha Hotel, at which Mr. Aylesworth declared that within the next ten years public utilities will sell their securities over the counter in scrip form. He contrasted customer ownership of public utility stocks with political ownership and showed to what an enormous extent the people by direct ownership and through ownership by life insurance and other mutual companies were interested in the welfare of public utilities. Dozier A. Devane of Washington, D. C., a former member of the Florida Railroad Commission, supported Mr. Aylesworth's views and advocated that employees "sell" their companies to the users of public service. He pointed out that all public utilities had the common-law right to make rates themselves without any reference to public service commissions and that the commissions could not initiate rates. There was a line beneath which the commission could not go. It was the line of confiscation. But if the public utilities, in going above that line, charged more than a reasonable price for the service rendered, then the commission intervened.

OFFICIALS AGAINST PUBLIC OWNERSHIP

W. H. Hallanan, State Tax Commissioner, said that next to the banks the public utilities are taxed closer to the legal mark than any other taxpayers in the state. He depreciated the idea of municipal ownership, as it withdrew taxable assets from the tax lists.

Governor Morgan asserted that he knew of some public utilities that were taxed higher than their properties would sell for on the open market. Speaking from his four and one-half years' experience on the Public Service Commission, he urged that all public utilities continue to give improved service and when increases are needed ask for only as much as is their just due. He condemned municipal ownership and said paternalism and bolshevism, which he described as socialism in action, were the two arch enemies of government.

The association elected C. P. Billings of the Wheeling Traction Company president. Vice-presidents chosen were C. H. Brues of Wheeling, Mentor Hetzor of Moundsville and W. R. Power of Huntington. A. M. Hill of Charleston was re-elected treasurer and A. Bliss McCrum of Charleston was again chosen secretary.

Emergency Surplus Appeals to Bankers

At Del Monte Convention They Indorse the Principle of a Revolving Fund Under State Regulation as a Means of Protection to the Investor

AT THE convention of the Investment Bankers' Association of America held at Del Monte, Cal., two weeks ago the greater part of one day's session was devoted to a discussion of the public utility situation. The delegates had been informed by Paul Shoup that California had unlimited resources to offer for legitimate development and that certain of its public service and other quasi-public corporation issues were among the choicest investments now known.

In the course of the discussion relative to the junior financing of public utilities, H. R. Hayes of Stone & Webster, C. Peirce of San Francisco, L. Chamberlain of New York and Mr. Allen of Allen & Company, Chicago, took a prominent part. Mr. Hayes declared that the provision of a surplus to guard against lean years, approved by state regulation, would pave the way for a confidence in many junior securities that does not now exist. Mr. Peirce said that if such a reservoir were established, to be drawn upon for dividends and interest in lean years, it would do away with the argument that advocates of municipal ownership put forth of ability to borrow money at lower rates. The rate of money, he said, is obviously governed by the risk to the investor. Reducing this risk by the creation of an emergency surplus under state authorization and regulation, it was asserted, would mean the strengthening of this class of securities and lend greater protection to the investor.

W. Ross of Chicago related the experience of Cleveland, where a stabilizing fund of $400,000 is created to provide for "lean times" in the railway business. When this fund drops below a specified amount car fares are raised to replenish it, and when it increases above the limit fares are reduced. The arrangement is elastic, but the principle is sound, declared Mr. Ross.

REGULATION PROTECTS INVESTORS

In his report on public service securities (published in part on page 945 of this issue) Chairman J. A. Prescott recommended that the convention indorse state regulation as a necessity in protecting the investors, saying:

"It therefore becomes obvious that if a corporation is prevented in times of peace from accumulating a cash reserve, it must be protected from the raids of uncontrolled competitors. The power to restrict vested in the hands of state authorities imposes upon such authorities the necessity and obligation to protect the corporation, and it is obvious that this protection is essential to the public interest.

"The protection, however, must not be carried to the point where the utility becomes indifferent to the public interest. It must be kept efficient through fear of competition in the event of failure to maintain its service. It has been determined that the best method of protecting the company from this destructive competition is for a state regulatory board to determine when and under what conditions utility service shall be extended into every given territory and to issue or decline to issue a 'certificate of public necessity or convenience,' which is a prerequisite to the construction of such extensions. In view of the large amounts of new capital required for additions and extension of facilities to provide for normal growth and the increased demands of various communities for new utility service, this committee feels that any effort which might result in reverting to discarded theories of competition in the public utility business would be destructive to the confidence that has been built up among investors in public utility securities and could not be other than harmful and expensive to both investors and the public served."

State Telephone Ownership Condemned in France

That the French Republic, where the government has a monopoly in the ownership and operation of the telephone system, has become weary of this arrangement is indicated in a report just submitted to the Chamber of Deputies by a commission appointed by the Chamber to make recommendations for the improvement of the French system, declared by hostile critics to be the worst in the world. This report, says a cable dispatch to the New York *Times*, recommends that the state turn the telephones over to a private company.

The report is based on investigations in the United States, Sweden and Norway. It says that in those countries the whole management of the telephone systems, from the chief director to the operators, is specialized, whereas in France one department runs the post offices and telegraph and telephone lines, and that in all services there is a lack of specialists and a superfluity of politicians. "In these countries," says the report, "the management is always trying to get new clients, whereas in France we just let clients come when we don't discourage or refuse them."

Deputy Jean Lambert, who heads the commission, declared that France must base her telephone system on the commercial spirit or it will never be good. He recommended a system like that of the United States, with telephones operated by private companies under government supervision. This recommendation is especially significant in view of the recent decision of the French government to go out of the railroad business and indicates the general trend away from state operation of utilities as inefficient and uneconomical. For the last two years the telephone administration has, it is said, been doing its best to discourage applications for telephones, the extra charge of 700 francs a year being frankly explained as for the purpose of preventing those who wish service from asking for them.

Oklahoma Men Meet

Tulsa Conference of Utilities Electric Division Considers Service and Public Relations

SERVICE and plant problems occupied a prominent part on the program of the Oklahoma Utilities Association's electric light and power division at the district meeting in Tulsa on Oct. 17. Fifty public utility men attended this one-day conference, and another meeting on Dec. 1 is contemplated. James H. Buell of the Oklahoma Power Company's Tulsa plant read a paper on plant construction and operation.

P. B. Stockwell, engineer of the Corporation Commission, told how public relations can be improved by giving customers the fullest information upon matters affecting service and rates. He cited instances where meager information given by employees to customers caused dissatisfaction and resulted in complaints to the commission. Some objectives the association was trying to accomplish by the speakers' bureau were outlined by Fred W. Insull, president of the association.

With the Oklahoma Public Utility Information Bureau sending letters each week to 255 newspapers in Oklahoma, O. D. Hall, acting secretary of the association, stated that the bureau had passed the experimental stage and was now operating successfully. He said that most editors of the state had gained confidence in the bureau and that they had come to rely on the news letter as a dependable source of utility information. He advised public utility operators not only to advertise more extensively but to keep their local newspapers fully informed relative to their improvements and their operating problems. Several manufacturers and jobbers were present, and they pointed out ways in which central-station operators could co-operate more fully in extending the sale of electrical energy.

An instructive address was given by C. L. Procter, general manager Empire District Electric Company, Joplin, Mo., on the subject of company organization and management. He said public utility managers should be pleasant, accommodating and progressive "boosters" for their own communities and should help to surround themselves with an organization that will give their patrons the most efficient and courteous treatment.

Salt Lake Has Fine Show

Rocky Mountain Electrical Exposition Scores Success and Wins Public Applause

LARGE attendance and a high degree of public interest marked the Rocky Mountain Electrical Exposition held under the auspices of the Rocky Mountain Electrical Co-operative League at Salt Lake City in the fortnight from Oct. 2 to Oct. 14. Both the exhibits and the electrical displays were on a scale never before attempted in the Utah city. The archway of jewels, illuminated each evening by a battery of twenty 18-in. searchlamps, proved a large factor in advertising the exposition, its brilliance drawing the admiration of the visiting throngs.

The Mayor of the city opened the exposition, which was held in the Bonneville Pavilion, and a set program was carried out every day, including radio concerts, demonstrations of high-frequency, high-tension current, educational talks on the use of electrical appliances in the home, demonstrations and experiments in the "Hall of Electrical Wonders," dancing and orchestral music. The demonstrations and experiments were made by P. P. Ashworth of the Utah Power & Light Company and H. T. Plumb of the Salt Lake City office of the General Electric Company. Mr. Plumb's "stunts" included the production of artificial thunder and lightning, the wireless transmission of light and demonstrations of corona. A spectacular electrical parade held on the evening of Oct. 5, a public wedding with electrical presents donated by dealers, prizes of electrical appliances for the winners of contests and the designation of certain days as "Old Folks' Day," "Students' Day" and so forth added to public interest.

The Rocky Mountain Electrical Co-operative League maintained an information bureau and rest room where its achievements and aims were presented to the public. The advertising and publicity program, launched about two weeks prior to the opening and continued throughout the period of the exposition, consisted principally of newspaper display advertisements and publicity stories, billboards, mailing "stuffers," street banners, window cards, automobile signs, street-car banners, motion pictures, radio announcements by Salt Lake City daily newspapers, circular letters and co-operative advertising by various business firms.

Among the exhibits that attracted most attention were those of the Utah Power & Light Company, the Union Pacific Railroad Company, the General Electric Company, the Westinghouse Electric & Manufacturing Company, the Mountain States Telephone & Telegraph Company, the Edison Lamp Works, the Utah Copper Company, the Western Union Telegraph Company, the Intermountain Electric Company, the Capital Electric Company, the Western Electric Company and the Mine & Smelter Supply Company. The total list of exhibitors embraced fifty-five companies and firms, representing not only the Intermountain States but both coasts and the Middle West as well. A. M. Jackson was manager of the executive committee, P. L. Goddard secretary and R. C. Nash treasurer. The chairmen of other committees were: Exposition, P. M. Parry; finance, W. S. Hodgson; exhibits, H. M. Ferguson; electrical features, P. P. Ashworth; advertising, M. L. Cummings, Jr.; music, E. L. Dee; Commercial Club, J. L. Bracken; arch and searchlight, C. R. Higson; co-operation with engineering organizations, H. T. Plumb.

Supreme Court Sets a Date to Hear Water-Power Motion

The United States Supreme Court, before entering on a three weeks' recess last Monday, set Jan. 2, 1923, as the date to hear the motion of the federal government to dismiss the case brought by the State of New York challenging the constitutionality of the federal water-power act of 1920. The government bases its motion on the ground that the state has not brought the suit against the proper federal officials or presented a concrete controversy over which the court has jurisdiction.

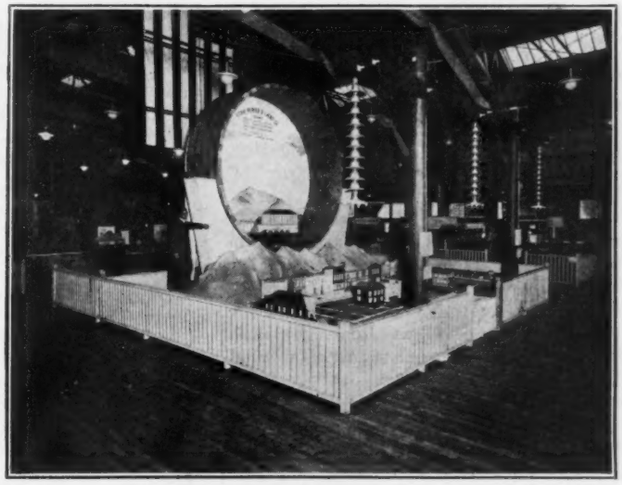
Technical Telephone Journal Appears

Vol. 1, No. 1, of the *Bell System Technical Journal* has been published. It is devoted to the presentation of technical and scientific articles in the field of communication engineering. It outlines its policy to collect, reprint and print articles of this character wherever obtainable in order to make them more available for communication engineers. The magazine is to be issued quarterly and has Dr. R. W. King as its editor with a consulting editorial board consisting of J. J. Carty, Bancroft Gherardi, E. B. Craft, F. B. Jewett, L. F. Morehouse, O. B. Blackwell, H. P. Charlesworth and E. H. Colpitts of the Associated Companies of the Bell System.

Public Utility Industry Is the Most Stable, Webster Says

"Any reasonable financing requirements of public utilities can now be met," said Edwin S. Webster, president Stone & Webster, Inc., to managers of railway, electric and gas properties under the organization's administration at the annual convention of executives held recently at Boston. Contrasting financial conditions of today with those prevailing at last year's meeting, Mr. Webster pointed out that during the twelve months the industry has had a very satisfactory and improving market, with declining interest rates for public utility securities. There should therefore be no present difficulty in financing any reasonable extension at a rate of interest from 2 to 4 per cent under what would have been needed a year ago.

"Since the beginning of the European war," the speaker said, "conditions have required the putting off of extensions as far as possible. In financial centers today, however, there is a better understanding of the whole public utility problem and a greater confidence in the business, which has proved, under the trying period which has been passed, to be the most stable of all industries."



GENERAL VIEW OF EXHIBITS, AND BOOTH OF THE UTAH LIGHT & POWER COMPANY

Industrial Engineers Discuss Economics

Elimination of Waste, Fundamentals of Maximum Production, the Engineer in Business and Welfare of Workers Are Among Topics at New York Convention

THE economics of industry was the main subject of discussion at the ninth annual convention of the Society of Industrial Engineers, which met in New York City on Oct. 18, 19 and 20, and an effort was made to determine the fundamentals necessary to maintain maximum production with minimum effort, waste and cost. The report of the American Engineering Council's committee on elimination of waste in industry shaped to a considerable extent the proceedings of the convention, at which the viewpoints of both worker and managing executive were presented.

President Joseph W. Roe, who is a member of the executive board of the American Engineering Council and head of the department of industrial engineering at New York University, in his opening address, said that the "hard-boiled" factory manager has been forced to accept the pure scientist from the laboratory and that the engineer, the chemist, the metallurgist, as the case may be, is now as accepted and necessary a part of large-scale industry as is the accountant.

"We are at another joining of the ways," added Professor Roe. "Fifty years ago it became apparent that industrial waste and mechanical inefficiency were no longer negligible. Today, with the increasing scale of production, it is becoming evident that social wastes are no longer tolerable."

A major cause of overproduction, according to Professor Roe, is the ignoring of the law of diminishing returns by industrial leaders.

ENGINEERS IN BUSINESS

J. H. Pardee, president of the J. G. White Management Corporation, New York, discussing "The Part of Economics in the Formation of a Policy of Business Administration," said that the engineer has presented the broadest and most comprehensive points of view of business practices.

Ernest Du Brul, general manager of the National Machine Tool Builders' Association, Cincinnati, speaking on "The Economic Aspect of Production," said that the idea that mere fabrication creates value is a common error of industry, continuing:

"The biggest and the most failures have been among the manufacturers of various kinds, fabricators of goods. Do these failures not indicate that something is very wrong with the economics these men applied in management? Business gets into such a state because business managers start out on false premises due to incomplete knowledge of economic theory."

Frank B. Gilbreth and L. M. Gilbreth of Montclair, N. J., presented a paper on "The Relation of Fatigue Elimination to Other Activities," which urged that the fatigue committee of the society work along two lines: First, increasing co-operation with others engaged in other types of work; second, development of units, methods and devices that will be useful in the elimination of unnecessary fatigue.

A feature of the convention was a discussion by William Geiger of Newark, representing the workers, and John A. Faust of New York, representing the executives.

Robert B. Wolf of New York, vice-president of the American Society of Mechanical Engineers and a member of the Hoover committee on waste in industry, in an address on "The Importance of the Elimination of Waste to the Economic Structure," said that in order to reduce industrial waste to a minimum industries must be so organized as to stimulate the workers' process of thinking.

Other prominent speakers at the convention covered a wide range of activities. Professor Roe was re-elected president of the society, F. C. Schwedtman of New York treasurer and George C. Dent of Chicago secretary and business manager.

Engineering Men Observe "Management Week"

"Management Week" meetings, bringing forcibly to public attention the increasing importance of the engineer in industry, were held in thirty cities in the week of Oct. 16-21, under the auspices of the American Society of Mechanical Engineers, the Society of Industrial Engineers and the Taylor Society. With these societies other engineering organizations and civic and economic bodies co-operated. Especially noteworthy were the meetings held in New York, Chicago, Indianapolis and Cambridge, Mass.

Messages presenting the American, the English and the German points of view were read at meetings throughout the country. Dexter S. Kimball, president of the A. S. M. E., speaking for the American engineer on the question of management, expressed the following views:

"The engineer has been drawn into the field of management partly because of his proximity to the problems of industry, partly because of the exigencies caused by the rapid growth of scientific methods, but more particularly because of his scientific method of attacking problems of all kinds. It has been found that his methods of attacking the problems of design and construction are powerful tools in handling the problems of administration. There can be little doubt that the engineering executive is to remain a dominant figure in industrial management. I do not contend that he alone can solve these human problems, but I do believe that if he will give his best effort to this work he can make a contribution that will go a long way toward the attainment of industrial peace."

James F. Whiteford, discussing the "Development of Management in the United Kingdom," said: "In general, it may be stated that management practices in the United Kingdom are following very closely the same sequence of developments as have been instituted in American industries. The application over here is a few years late, but the best portion of the practices in American industries are being fairly generally accepted over here."

G. Schlesinger of Charlottenburg, Germany, told of "The Development of Scientific Industrial Organization in Germany," saying: "It gives me pleasure to be able to place before the American industrial world some proofs of successful results in scientific and practical industrial organization in Germany. I am convinced that after a long period of 'lagging behind' we have at last caught up with the Americans in scientific management; but the deeper foundation that we possess and the greater economy in the manipulation of our system (we can carry out the work of accounting in factories according to our method with half the personnel that is required with the usual American system) will perhaps prompt American industry to take note of our organization, science and practice, as the German industry once gladly and gratefully accepted advice and information from American sources."

Oregon Commission's Rules for Rural Service

After many preliminary trials and hearings, the Public Service Commission of Oregon has promulgated a new set of rules for rural service which became effective on Oct. 15.

By the new rules the utility is required to finance and construct a rural extension on its own right-of-way where the cost does not exceed four dollars for each dollar of minimum annual revenue to be obtained from the extension. Should the cost exceed the above sum, the utility may require an advance deposit from consumers covering the excess cost estimated on a pro rata basis.

If the extension is on the consumer's right-of-way, the consumer is required to finance the entire extension and the construction work must be done by the utility at the expense of the consumer. The ownership of a completed rural district system is vested in the utility, and it is responsible for operation, maintenance and replacements. Rules are made covering refunds, rates and accounting methods, and the way is paved for arbitration by the commission in disputed cases.

Headwater Regulation Next

Rules Affecting Improvement Will Be Based by Power Commission on Broad Principles

WITH the depreciation and accounting regulations on the road to solution, the staff of the Federal Power Commission now is turning its attention to the headwater improvement regulation. Every effort will be made to obtain the best thought in the industry in the formulation of this very important regulation. Fully as much gray matter must go into the drafting of it as has been required in the formulation of the two other regulations mentioned.

The commission's staff is engaging in this work with the idea of setting up certain broad principles. Conditions vary so widely on different streams that it is recognized that any effort to apply detailed rules would result in an unnecessary burden on water development.

Under existing conditions the one who creates a headwater benefit gets nothing from it unless he can arrange a working agreement with the project further down the stream. The ideal condition, it is pointed out by the Federal Power Commission men, would be to have each river developed by a single concern. Since this is manifestly impossible, a plan must be worked out whereby reservoirs can be operated to the maximum advantage of several projects.

The importance of this regulation will be better understood when it is considered that it will apply to a very large number of streams, among which are the San Joaquin, Mississippi, White, Ouachita, Grand, Green, Columbia, Clamath, Deschutes, Feather, Yuba, Stanislaus, Merced, Kings and Kern.

There is acute need at this time on the San Joaquin River for the determination of the commission's headwater policy. The headwaters of that system have been improved by the Southern California Edison Company. Below this large reservoir system, now partly constructed, the San Joaquin Power & Light Company has an important plant. The operation of that plant could be materially affected by the handling of the reservoir system.

There will be need on the Mississippi in the near future for the determination of questions arising as to the handling of reservoirs. The War Department stores water on the headwaters of the Mississippi for navigation purposes. Other reservoirs will be constructed in the near future in that region. There already is a demand to know just how that storage will be handled.

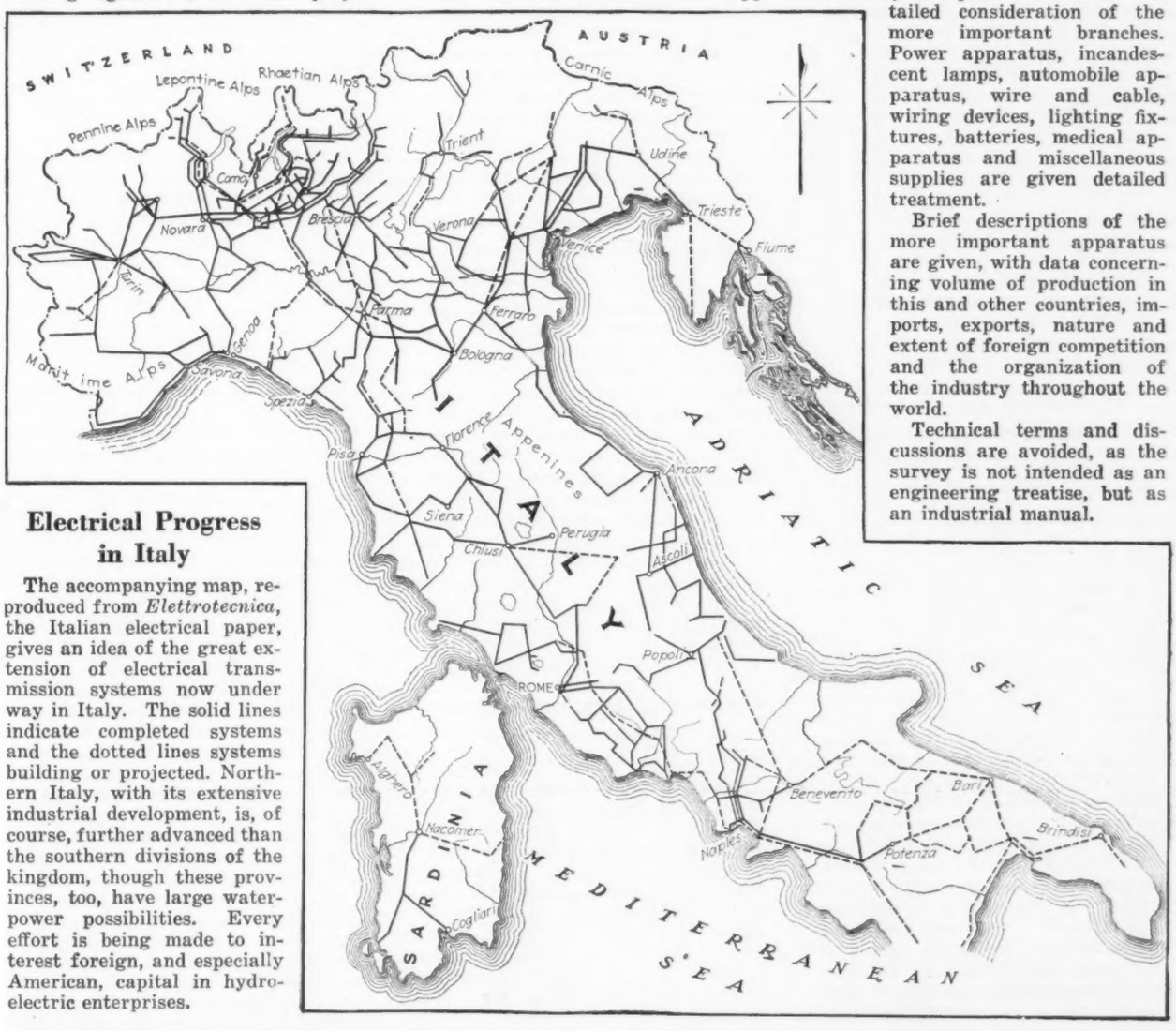
The Chippewa is an example of a river which is controlled under a state law. The Flambeau reservoirs are operated under a charter from the State of Wisconsin under which a charge may be collected from each of the plants benefited.

Electrical Industry Survey Issued by Tariff Board

The Tariff Commission has just issued a tariff information survey on the electrical industry. Intended as an aid to scientific tariff legislation, it presents briefly the pertinent facts as to the competitive situation of the industry in the United States and abroad. A brief survey of the whole industry is followed by a separate and more detailed consideration of the more important branches. Power apparatus, incandescent lamps, automobile apparatus, wire and cable, wiring devices, lighting fixtures, batteries, medical apparatus and miscellaneous supplies are given detailed treatment.

Brief descriptions of the more important apparatus are given, with data concerning volume of production in this and other countries, imports, exports, nature and extent of foreign competition and the organization of the industry throughout the world.

Technical terms and discussions are avoided, as the survey is not intended as an engineering treatise, but as an industrial manual.



Electrical Progress in Italy

The accompanying map, reproduced from *Elettrotecnica*, the Italian electrical paper, gives an idea of the great extension of electrical transmission systems now under way in Italy. The solid lines indicate completed systems and the dotted lines systems building or projected. Northern Italy, with its extensive industrial development, is, of course, further advanced than the southern divisions of the kingdom, though these provinces, too, have large water-power possibilities. Every effort is being made to interest foreign, and especially American, capital in hydro-electric enterprises.

Condemns Burning Raw Coal for Power Generation

Advocating the establishment of a permanent bureau of coal economics to furnish the country with the truth concerning wages, prices and other details of the coal situation, Floyd W. Parsons, editorial director of the *Gas Age-Record*, told the Western Society of Engineers at Chicago on Oct. 9 that this is one of four steps that should be taken toward the solution of the problem. The other three were to set up a legal definition of what constitutes a fuel emergency, including a minimum below which the total coal supply of the country must not pass; the institution of compulsory arbitration, and provision enabling the government at some stage of any controversy to step in and take over the industry and operate it till a settlement shall have been reached. Mr. Parsons said that the cost of the last coal strike was $1,200,000,000 and that even if the cost of intervention on the part of the government had been $500,000,000 there would still have been a material saving. He asserted that the mining of coal is not seasonal to the extent generally believed, the production of bituminous during the six warm months averaging about 43,000,000 tons per month and in the other six months about 57,000,000 tons.

Mr. Parsons held that much can be done by storage and proper distribution of buying to enable the mines to operate more efficiently and to relieve the railroads of heavy haulage during the cold months. Reduction of the number of miners and consolidation of many of the smaller mines were advocated. He also took a stand against burning coal in its raw state, saying that the various by-products should be extracted and used, the gas being employed for power generation.

Movement to Co-ordinate Engineering Activities

At the call of the president of the American Institute of Electrical Engineers, the chairmen of several committees of the Institute, of the National Electric Light Association, of the American Electric Railway Association and of the Association of Edison Illuminating Companies, all dealing with power-station problems, met in New York last January to arrange some plan for co-ordinating the work of the committees to prevent undesirable duplication and so as to allocate subjects to the proper bodies. During the recent meeting of the Technical Section of the National Electric Light Association at Milwaukee another gathering of these men, together with their successors in the committee chairmanships, was held, and it was decided that the committee on co-ordination should hereafter consist of those who are serving as chairmen of the several committees concerned, in place of those originally participating.

These committees are the electric machinery and power-station committees of the American Institute of Electrical Engineers, the prime-mover and electrical apparatus committees of the National Electric Light Association, the committee on power generation of the American Electric Railway Association and the steam-turbine and generator committee of the Association of Edison Illuminating Companies. It is understood that representation was desired from the American Society of Mechanical Engineers, but the organization and work of that association is arranged in such a way that there are no committees whose work corresponds in scope with that of the committees represented.

At the Milwaukee meeting it was decided also that the chairman of the power-station committee of the American Institute should act as chairman of the co-ordinating committee. One means, and an effective one, of bringing about the desired co-ordination is by an interlocking committee membership, and several appointments to committees have been made with that in view. This enables all committees to be familiar with the work of the others. While the American Institute deals more particularly with the technical and scientific side of the power-plant problem, the other committees are interested in new developments, operating problems and application of equipment. Working alone, the various organizations to a greater or less extent duplicate each other's work. Set up as the co-ordinating committee is, the duplication of effort can be eliminated and the greatest good obtained with the least effort.

Arkansas Utilities Association Formulates Program

The keynote of the convention of the Arkansas Utilities Association, which meets at Hot Springs Nov. 7, 8 and 9, will be the promotion of good public relations, with the object of more and better business and the resultant upbuilding of the state. Among the speakers expected are E. W. Lloyd of the Commonwealth Edison Company of Chicago, past-president of the National Electric Light Association; W. F. Wickshire, secretary of the Ohio Brass Company, Mansfield, Ohio; Earle Hodges, director of the Arkansas Public Service Information Bureau; Judge E. B. Downie and C. Hamilton Moses, all of Little Rock.

Colorado River Commission to Meet on Nov. 9

The much-postponed meeting of the Colorado River Commission is now announced to begin on Nov. 9 at Santa Fé, N. M. Secretary Hoover of the Department of Commerce has made arrangements to attend. According to Washington advices, enough is known as to the sentiment within the seven states concerned immediately with the use of the waters of the Colorado to indicate that a final settlement will probably be reached at the coming hearings.

Brief News Notes

Hydro-Electricity in Jugoslavia.—According to government figures just published, Jugoslavia possesses about 3,500,000 hp. of available water power, of which only 160,000 hp. is utilized. Efforts are being made by the Belgrade government to interest foreign capital in the electrification of the country.

Sioux City Companies to Merge.—A merger of the Sioux City Gas & Electric Company and the Sioux City Service Company is under way, having been approved by the City Council as well as by a popular vote. A twenty-five-year franchise will be granted to the new company. The details will probably be completed next month.

Code Revision Committee to Meet.—The committee having charge of the revision of Part 2 of the Electrical Safety Code will meet in Washington early in November to draw up standard specifications for wire crossings and other matters pertaining to overhead lines. Any one having suggestions to make is asked to acquaint members of the committee or the Bureau of Standards at Washington.

Uniform Rates Established at Chicopee.—The Chicopee (Mass.) municipal electric light department has reduced its sliding scale of charges, establishing a maximum of 6 cents per kilowatt-hour and abolishing the difference in rates for energy used for power and lights. A flat charge of 35 cents a month for each consumer has been imposed as a service charge. The new rates will be effective Dec. 1.

Watonga Accepts Central-Station Service.—On Oct. 4 the city of Watonga, Okla., cut in on the Oklahoma Gas & Electric Company's transmission line and abandoned the local municipal electric plant. Watonga will be operated under the Enid division and will purchase wholesale energy. The municipal plant was abandoned because of the inefficient high cost of operation, limited capacity and the fact that it supplied only eighteen-hour service. Geary, 15 miles south of Watonga, will also have central-station service as soon as the transmission line is completed.

Automatic Telephone Service Between Subscribers Inaugurated in New York City.—Telephone subscribers connected with the Pennsylvania exchange in New York City began calling their own "parties" last week and got along as well as formerly, when the telephone girls did the work, according to the report of the New York Telephone Company. Seventeen hundred trunk lines and a total of 9,000 telephones were changed over from the old-style of operation to the new method by which the subscriber manipulates a dial on his own telephone and is connected mechanically with the number which he is

seeking. Instructors had been working for many weeks. There are approximately 1,050,000 telephones in New York City, as well as tens of thousands of unfilled applications for instruments, and it will be more than ten years before the machine-switching telephone will have completely supplanted the present type.

Transmission Line Built in Record Time.—Building a transmission line 19 miles long in thirty-three actual working hours is a record established by the construction crew of the Mountain States Power Company at Myrtle Point, Ore. This three phase, 20,000-volt line connects Myrtle Point with Powers, Ore. A logging railroad paralleled the right-of-way, and by means of a locomotive crane the 334 poles were set in twenty-two and one-half hours. The No. 4 hard-drawn bare copper wire was strung by the aid of this crane in ten and one-half hours.

Japanese Railroad Electrification.—According to the *Japan Advertiser*, another big electrification project has been adopted by the Japanese Department of Railways, involving the electrification of the Tokyo-Odawara and the Tokyo-Yokosuka lines. The new project insures the electrification of the whole trunk line from Tokyo to Kobe. The work is to be started with the laying of overhead cables over the present tracks from both terminals. Most of the power is to be obtained from private power companies along the line, about twenty-five transformer stations being required between Tokyo and Kobe. The entire expenditure is estimated at 67,000,000 yen (about $33,500,000).

Washington Water Power Company to Take Over Okanogan Plants.—Through a stock merger the Washington Water Power Company will on Jan. 1 next take over the Okanogan Valley Power Company, operating two hydroelectric plants with 100 miles of transmission lines that supply light and power to towns and farming districts of the Okanogan Valley. The Washington Water Power Company will extend its lines into the new field to connect with the south end of the Okanogan territory at Pateros on the Columbia River. It is estimated that the connection will require from 55 miles to 70 miles of 60,000-volt transmission lines.

Hydro-Electrical Growth in Maine.—In order to keep ahead of demands the Central Maine Power Company has embarked on plans which call for the development of 6,800 additional horsepower. About 1,000 hp. will result from the redevelopment of the Union Gas & Electric Company plant on the Messalonskee stream in Waterville and 4,300 hp. from placing a new generating unit in the Skowhegan plant. About 1,500 additional horsepower will be provided by placing another unit in the Deer Rips station in Lewiston. In August, normally a dull month for power, there were days when the demand for service from the Skowhegan plant was so great that electricity had to be generated by steam in the Farmingdale station.

New Hydro-Electric Plant Begun at Wendell, N. H.—The Lake Sunapee Power Company, recently incorporated under the laws of New Hampshire with a capital of $300,000, has begun the construction of a 1,000-hp. hydro-electric generating plant at Wendell, N. H., on the Sugar River. The work includes a new dam and steel penstock, with generating machinery. A ten-year contract has been entered into between the Lake Sunapee company and the central-station companies supplying energy to Newport and Sunapee, N. H., and the lighting companies have an option to purchase the Lake Sunapee company's development at an appraised value, fixed in such case by the Public Service Commission.

Potomac Company Expanding.—In order to take care of expanding business, particularly in the domestic lighting field, the Potomac Electric Power Company of Washington, D. C., has appropriated $1,500,000 for plant improvement and extension in 1923, or $500,000 more than its recent annual expenditure for this purpose. The generating plant is being changed over for direct 60-cycle generation. One 12,500-kw. generator is being installed to replace a 9,000-kw. vertical unit. The new generator will be in operation in November, and another of the same type has been ordered for delivery Jan. 1 to replace a 5,000-kw. vertical unit. An additional high-tension 13,000-volt line from the Bennings power house to the substation is planned.

Village Plant Gives Up After Nine Years.—The taxpayers of the village of Lone Rock, Wis., have voted, 120 to 2, to abandon their municipally owned electric plant. Testifying before the Wisconsin Railroad Commission, the president of the village said that the power plant was broken down and entirely out of commission, although $1,000 had been spent for repairs in seven months. "We have been charging 18 cents per kilowatt-hour and that sum has not been sufficient to meet our cost of operation; I think the cost of operation is nearer 25 cents per kilowatt-hour," said the president. "It is for the best interests of the village to sell its plant and distribution system and contract for power and light from the privately operated company, which will supply us with electricity at 12½ cents, net, a kilowatt-hour."

Leipzig's Electrical Exhibition.—From Leipzig, Germany, comes an account of the annual autumn fair held there, which this year lasted from Aug. 27 to Sept. 2 with a record number of exhibitors and visitors, the latter being put at about 155,000, of whom 26,500 were foreigners, and the former reaching 13,019. It is claimed that this is the largest commercial fair in the world. The technical part of the exhibition is held in fifteen large halls, and electrotechnics holds the leading place. A splendid new building, to be called the "Haus der Elektrotechnik," is in course of erection for this display, which embraces practical devices of all kinds required in electrical installations, switches, insulating material, heating and cooking apparatus, lamps and lighting apparatus, meters, household appliances, electrotherapeutic devices, as well as heavy machinery for generating plants and, in short, electric manufactures of every description.

Associations and Societies

Wisconsin Utilities Association.—The 1923 convention of this association has been fixed for March 22 and 23 at the Hotel Pfister, Milwaukee.

Toronto Section, A. I. E. E.—The October meeting of this section had a record attendance of 170. Frank Ewart, a vice-president of the Institute, described its aims, and an attractive program of papers by prominent engineers was outlined for the coming season.

Cleveland Section, A. I. and S. E. E.—At the November meeting of the Cleveland District Section of the Association of Iron and Steel Electrical Engineers, J. S. Rowan, president Rowan Controller Company, Baltimore, will present a paper on "Installation and Care of Automatic Controllers in Steel Mills." The paper for the December meeting will be by Charles W. Burrows, New York, on the "Commercial Application of the Magnetic Analysis in the Iron and Steel Industry."

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Electric Power Club—Asheville, N. C., Oct. 30-Nov. 2. S. N. Clarkson, Kirby Bldg., Cleveland, Ohio.

Arkansas Utilities Association—Hot Springs, Ark., Nov. 7-9. R. P. Brown, Little Rock Ry. & Electric Co., Little Rock.

Electrical Credit Association (interstate convention)—Philadelphia, Nov. 10. J. W. Crum, 1328 Land Title Bldg., Philadelphia.

Ontario Association of Electrical Contractors and Dealers—Toronto, Nov. 13-14. J. A. McKay, 24 Adelaide St. W., Toronto.

National Association of Railway and Utilities Commissioners—Detroit, Nov. 14-17. J. B. Walker, New York Transit Commission, New York.

Electrical Manufacturers' Club—Hot Springs, Va., Nov. 15-19.

Electrical Credit Association, Central Division—St. Louis, Nov. 16-17. F. P. Vose, 1347 Marquette Bldg., Chicago.

Electrical Supply Jobbers' Association—Cleveland, Nov. 20-24. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Society of Mechanical Engineers—New York, Dec. 4-8.

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Gordon Square Bldg., Cleveland.

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

National Electric Light Association—New York, June 4-8.

Commission Rulings

Competing Company Allowed to Enter Occupied Territory When Inadequate Service Is Proved.—A second electric utility may, according to a decision of the Indiana Public Service Commission in passing upon a petition from the municipal authorities of Parker City, be permitted to render service in a municipality where it is shown that the utility in possession is rendering inadequate, insufficient and unsatisfactory service, that there exists no reasonable prospect of improvement and that adequate and satisfactory service could be obtained from the utility desiring to enter the field.

Proper Charge for "Contact" Service.—The Wisconsin Railroad Commission has permitted the Oconto Service Company to increase its rate to the Oconto Electric Company for "contact" rental. The commission found that the relation which the total expense of operating and maintaining the poles, wire supports and wires of an electric utility bears to the investment in distribution system, excluding meters and transformers, may fairly represent a proper relation between these items, excluding wires, in a proceeding to determine a proper charge for contact service supplied to another utility. A return of 8 per cent on the investment in poles, cross-arms and insulators was allowed.

Inadequate Past Earnings and Past Deficits in Relation to Rates and Going Value.—The New York Public Service Commission, in arriving at a rate schedule for the Western New York Utilities Company, held that accrued depreciation should be deducted even though evidence was presented to show that the company had not had an adequate return and that therefore its reserve for depreciation as set up on its books had not been earned. The commission further declared that deficits over a period of more than twenty years do not constitute going value, since the public does not insure a utility against loss and said that if poor judgment has been exercised in the management of the company the present and future ratepayers should not suffer thereby.

Rates for Peak and Off-Peak Service.—In establishing rates for the Midwest Power Company the North Dakota Board of Railroad Commissioners made several observations respecting peak and off-peak service. The rates for commercial power service, it said, should be on a basis considerably lower than that fixed for commercial lighting since power service is largely an off-peak load and there is less expense in reading meters, accounting and collecting. Street lighting, which is metered with one instrument and is largely a peak-load service, compares very favorably with general lighting, and a rate for such service may be determined by establishing a rate equivalent to a further step in the commercial lighting scale. A low rate, the commission held, should be established for cooking by electricity, since this service is almost entirely an off-peak load and comes into close competition with fuel, making a low rate advisable from the standpoint of development.

California Commission Orders Coast Valleys Company to Extend Service.—The California Railroad Commission in two related decisions denied on rehearing the Del Monte Light & Power Company's request to serve East Monterey and Seaside and ordered the Coast Valleys Gas & Electric Company to serve this district. The two companies are closely related, the Del Monte company buying its electrical energy from the Coast Valleys. The commission held that the latter company was better able to serve the district in question and that it was its duty to extend its lines when applications were made for service. The Coast Valleys company objected to extending its lines on the ground of cost, but the extension was ordered made without expense to consumers and completed by Dec. 1.

Overhead Construction Rules Will Be Strictly Enforced in California.—Charged with the enforcement of the state law in reference to overhead electric line construction, the Railroad Commission of California has issued an order directing the Pacific Gas & Electric Company to eliminate by Aug. 1 of next year specified infractions of the law in its San José division and by Dec. 31 of next year to bring its entire system within the provisions of the law and the regulations of the commission. This order follows an inspection in the San José division made by engineers of the commission and representatives of the utility. According to the report 13,972 infractions of the law and other hazardous conditions were found. The original act, adopted in 1911, required all overhead electric line construction to conform to specified standards and gave the utilities five years to bring their old construction up to the new standards. In 1915 the law was amended to give the commission discretion in granting extensions of time and also to place the duty of enforcing the act upon the commission. Owing to the scarcity of labor and the high cost of material during the war period extensions of time were granted to all the utilities affected. Under the law as amended the commission has power to make additions or changes necessary for the safety of employees and the general public, and the commission now announces that it will require hazardous conditions to be remedied even when they are not in violation of the letter of the specified provisions of the state law. In the case of minor infractions existing prior to 1911 the commission said that extensions will be granted so that these conditions will be corrected in the ordinary course of maintenance or reconstruction work. When work is required to be done on any pole the entire structure must be brought into full compliance with the law. A like order was issued applying to the Coast Valleys Gas & Electric Company, on whose system 4,178 infractions and certain other hazardous conditions were found. This company has until July 1, 1923, to complete compliance with the commission's order.

Recent Court Decisions

Powers of Public Service Commission Not to Be Extended by Implication.—The New York Supreme Court, Appellate Division, has found, in City of New York vs. Public Service Commission, that the statute creating the commission did not repeal by implication former statutes creating a board of commissioners of electrical subways for the city of New York and requiring corporations using electrical wires to run them through the subways, transferring the power of the Board of Electrical Control to the city of New York, and apportioning such powers among city authorities, and that the commission cannot exercise jurisdiction over the charges for the use of such conduits. Powers given to the Public Service Commission, the court holds, should not be extended by implication beyond what may be necessary for their just and reasonable execution. (195 N. Y. S. 815.)*

Combinations to Increase Price of Electrical Installations Not Exempt Under Labor Clause.—J. W. E. Johnson, a dealer in electrical apparatus, was indicted and convicted in Colorado of two offenses—setting up a combination to increase the price of electrical apparatus and endeavoring to increase the price of electrical installations. His defense was that labor was excepted from the statute by a special clause and that therefore any combination as to installation was lawful. The Supreme Court of Colorado has ruled as follows: "Since electrical apparatus is usually sold with installation, to control the price of installation would be practically to control the price of the apparatus and to defeat the law. It follows that the control of the price of installation in such a way as to control the price of the goods is unlawful unless the statute somewhere permits it. . . . While labor is not a commodity under this act, yet electrical apparatus is. The control of the commodity price is forbidden and any sort of combination to control or establish its price is unlawful. It is unlawful then to control the price of electrical apparatus by means of the control of the price of labor, and so holding we do not treat labor as a commodity. It cannot be said, therefore, that the control of the price of installation is permissible under the statute."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

Guthrie to Serve on Communications Board

Chairman Lasker of the Shipping Board recently designated F. P. Guthrie, head of the radio division operating department of the board, as the representative of the Shipping Board and Emergency Fleet Corporation to serve as a member of the interdepartmental committee appointed to study the problems to be considered at the forthcoming international conference on electrical communications.

A. Jydstrup is now treasurer of the municipal electric light plant, Summit, S. D., replacing L. N. Thompson.

Gus Hadwiger is now vice-president of the Southwestern Utilities Company, Alva, Okla., replacing C. B. Zeigler.

W. E. Phelps is now president of the municipal electric light and water plant at Carmen, Okla., replacing E. A. Young.

Charles O. Wood is now secretary of the Southwestern Utilities Company, Alva, Okla., replacing W. W. Heironimus.

William C. Elder is now secretary and treasurer of the Belle Center (Ohio) Light & Power Company, replacing R. F. Harrod.

Boyd Simpson is now director of public service of the municipal electric light plant at Bellefontaine, Ohio, replacing R. P. Hoover.

R. L. Hearn, formerly with the Hydro-Electric Commission of Ontario, is hydraulic engineer for the Washington Water Power Company, Spokane.

Herman Russell was recently appointed to the board of directors of the Rochester Gas & Electric Corporation in recognition of his services as vice-president and general manager.

Frank B. Faris, until recently chief examiner for the Public Service Commission of Indiana, has become associated with Haynes & Mote, attorneys at law and public utility counselors in Indianapolis.

J. W. Perry is retiring from his office as treasurer of the Associated Manufacturers of Electrical Supplies and also from his membership on the board of governors of that organization. Mr. Perry was the guest of honor at a dinner given on Friday evening, Oct. 20, at the Yale Club, New York City, by the present board of governors.

J. E. Brickenden has joined the staff of the Canadian General Electric Company, Winnipeg, Manitoba. Mr. Brickenden until recently was Western representative of the Canadian Edison Appliance Company, which has been absorbed by the Canadian General Electric. He will continue to look after the Hotpoint lines in Manitoba, Saskatchewan and Alberta and will handle the jobbing end as in the past, including the Canadian General Electric branches.

A. D. Flinn Heads Engineers

Alfred D. Flinn, who has been elected director of the Engineering Foundation, is the first incumbent of the new post created by the foundation's governing board—which is composed of the four founder societies of civil, mining, mechanical and electrical engineers—to meet expanding activities of the body.

©Underwood & Underwood

A. D. FLINN

From 1893-1902 he was identified with municipal engineering enterprises in Boston as a member of the engineering staff of the Metropolitan Water Works, and during his latter years with this organization he lectured in the Lawrence Scientific School of Harvard University. During 1905-1918 he was division engineer, department engineer and deputy engineer of the Board of Water Supply of the City of New York in the construction of the Catskill aqueduct and reservoirs. He has been associated with technical journalism as an editor and is the author of numerous books and articles on engineering.

G. B. McNair has been appointed district lighting specialist for the Westinghouse Electric & Manufacturing Company, with headquarters at Denver, Col. Mr. McNair will cover both the Denver and Salt Lake territories and will specialize on street lighting. Mr. McNair is a Purdue graduate and has until recently been a member of the organization of the Western Electric Company at Denver.

South Norwalk Shows Its Appreciation of A. E. Winchester

Albert E. Winchester, who has been general superintendent of the South Norwalk (Conn.) municipal plant for thirty years, was recently the recipient of a purse of a thousand dollars from his fellow-citizens in token of their appreciation of his work in the community. Mr. Winchester is widely known in New England and has a host of friends. As an engineer and an active member of the A. I. E. E., he has a reputation for ability and enthusiasm, and his good citizenship has given him as well an enviable standing among his fellow-townsmen generally.

Eugene E. Harrington has been appointed superintendent of the Lake Sunapee Power Company, Sunapee, N. H., in charge of the power plant which this recently organized company has under construction.

A. J. Reed, until recently general sales manager for the Robbins & Myers Company, Springfield, Ohio, has joined the Ohio Electric & Controller Company in the capacity of district sales representative of the motor department. His headquarters are in Philadelphia.

Obituary

John S. Lucock, for sixteen years superintendent of the Detroit Insulated Wire Company, Detroit, died Oct. 10. Mr. Lucock was born in England in 1865 and came to America at the age of eighteen. For many years he was connected with the Western Union Telegraph Company and in 1903 became superintendent of the National Cable & Wire Company in Pittsburgh. In 1906 he moved to Detroit and joined the Detroit Insulated Wire Company, remaining there until his death.

James M. Petrie, chief engineer and general superintendent of the Virginian Power Company, died suddenly at his home at Charleston, W. Va., on Oct. 9. Mr. Petrie's early work was confined to marine engineering, but later he became engaged in steam and electrical construction work in Mexico, in inspection work for the Maryland Casualty Company and as chief engineer for plant and distribution work for Kops Brothers, New York. After spending two years in the city of Panama as chief engineer for the Panama-American Corporation, Mr. Petrie became chief engineer for the Virginian Power Company and subsequently was appointed its general superintendent in charge of all engineering and construction work. He was also vice-president of the Engineering Service Corporation of Charleston and president of the Nitro Power Company of Nitro, W. Va. Mr. Petrie was born in Jersey City and was thirty-nine years of age.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Distribution Trouble Not All for the Young

A Plea for More General Recognition of the Fact that the Old Manufacturer and the Old Jobber Have Problems Too and Have Had Them Since Their Youth

By L. L. Brastow

Sales Manager Trumbull Electric Manufacturing Company, Plainville, Conn.

A GOOD DEAL has been published of late concerning the troubles of the small manufacturer in distributing his goods. It is comparatively easy to point out the problems facing jobber and manufacturer, both large and small. But the solution is a different thing.

The smaller and less known manufacturer, not being able to tie up with the larger jobber who has already made his arrangements, naturally ties up with the smaller and less experienced jobber. This is not surprising and should have been foreseen—in fact, is foreseen and thoroughly understood by the new manufacturer, who before he starts to produce has not counted on much assistance from the old-line jobbers who have been tied up with satisfactory connections for some time.

L. L. BRASTOW

Newcomers Must Always Fight

It is not so much a question of "kept" jobbers who will not sell the small manufacturer's competing line. They represent only a small percentage of the fully recognized jobbers of the country. It is a question of establishment and prior connections which are not easily broken. It would be a most unfortunate affair if long-established relations between manufacturer and jobber were broken off first here and then there whenever a new source of supply came into being.

With every new manufacturer can be found several new jobbers. They may not function as do the older jobbers. Neither do the new manufacturers function as do the older manufacturers. Experience and maturity surely count for something. Neither manufacturer nor distributor can "arrive" all at once.

The experience of every new manufacturer and new jobber of today merely duplicates that of older manufacturers and jobbers when they, too, were new. It is an uphill fight to get recognition on the part of both. No institution is going to change relations sight unseen or overnight.

The new manufacturer of necessity must break into the middle of the line of distribution for his outlet. It has always been so. It is not a new thing, and the fact that a portion of the larger jobbers are owned by or tied up with the two large manufacturing companies has only a partial bearing on the subject. The control by contract or by financial backing of a jobber by a manufacturer very often does not tie up such a jobber as tightly as theory would indicate. They often break over in favor of a smaller manufacturer for this or that reason —mostly price—and thereon hangs another tale.

I cannot see that the present has any new problems in kind which the past has not held for the new manufacturer as well as new jobber. The problems, however, are more intense because of an excess in the number of both manufacturers and jobbers that is more than keeping pace with business expansion; and in trying to take business away from the older companies rather than in developing their own distribution systems they run into trouble.

Our own company in other days met the same situation. We were told even more plainly than is told today by the then established jobbers to "go create a demand and then come around." So we did that very thing and established our connections in the middle of the distribution line. We made jobbers of dealers just as is happening today. And many of these new jobbers of those days are large jobbers today.

We surely had a very strenuous uphill fight and could have written columns on our problems in dealing with the aristocrats of distribution. We went ahead as did the other youngsters and did the hardest work of all our existence and at last received recognition through the demand created by our energy and by the merit of our goods rather than by the price put upon them. Our young jobber connections also did some hustling and many of them have risen to prominence. Others passed out on the route upward.

Too many of the newer manufacturers and jobbers also are attempting to build their establishments on price and price alone—with service to needs and quality to high standards taking only secondary place. The future is not particularly bright for such. For those who have inventive brains and produce something new rather than copy what is now in abundance to be had—for such, if they will work and conserve, there is a future just as there has been in the past. You cannot keep a good man down—problems or no problems—"kept" jobbers or no "kept" jobbers.

Old Companies Have Trouble Too

But do not for a moment think that it is the new folks who have all the problems. The old ones blame the newcomers for as many troubles

as do the newcomers blame the older companies. It is fifty-fifty for each.

There is constant danger that by buying from the "newly-comes" old jobbers will force the older manufacturers to widen their distribution and "open up." It is no less a fear than the anxiety that because they are not getting easy "big jobber" distribution the "newly-comes" will disorganize the trade by price cutting and the lowering of electrical standards, and compel temporary recognition by the very pressure of suicidal prices with accompanying poor quality. Note the word "temporary," because there is a limit to all things, even price cutters and poor goods. Such methods rarely solve the problem of distribution. They may help temporarily if not carried too far, but they make everybody lose money and give the ultimate consumer only a slight advantage in price and a big disadvantage in quality.

The solution of the problem is to be found in closer tie-ups between given manufacturers and those who constitute their given jobbers. Perhaps it may line up in a general way that the older classes will play together—"kept" and "unkept" alike—and the newer folks will tie up together and fight their battles through or go out.

SURVIVAL OF THE FITTEST

The live young jobbers and manufacturers will win recognition, as they always have. The older manufacturers and old jobbers who go to sleep will lose to the livelier "newly-comes," as they always have. As the new folk must fight hard to get recognition, so the older folk must fight hard to keep what they have. And so it goes and always will go—the slothful die, the "go-getters" live. And no jobber, be he "kept" or not "kept," has any right to expect the faithful support of his source of supply unless he too does the distributing, and not the manufacturer, who will do all he can to create demand and make distribution easy, but who in the last analysis is not a selling agency.

There are plenty of live young distributors who will work. Moreover, no manufacturer who fails to sense his competition and does not by improved methods and progressive development make his lines easy for his jobber to sell can last forever, because there are plenty of live young manufacturers coming along. It is the survival of the fittest, with life for the active and resourceful.

Stimulating Research by Organization

Importance of Thorough Co-operation—Staff Should Be Active in Scientific Associations and Conversant with Current Technical Literature

By T. S. Taylor

Research Laboratory, Westinghouse Electric & Manufacturing Company

THAT research work, and hence the research man, is a very necessary part of any progressive manufacturing concern is no longer questioned. Probably the most important reason why any firm has established a research institution has been the fact that the usual methods of guess and try, as applied in many instances, were found to be entirely inadequate to meet the complex demands being continually made upon manufacturers. The engineer, being very busy trying to meet these demands, found he needed expert scientists well trained in technique and the fundamentals of their subjects to help him solve his problems. In fulfilling his obligations to his company the research worker may have to busy himself with problems arising from attempts to improve methods and apparatus, find substitutes and new applications, or he may have some problem of a purely scientific nature with apparently no immediate commercial application. The inherent nature of these latter problems naturally makes them the more attractive. The element of uncertainty and the possibility of finding something new give them an enticing aspect.

IMPORTANCE OF RESEARCH CHIEF

The most important personage in any well-organized research laboratory is the director. He should not only be a scholar well versed in the fundamental principles of laboratory technique and methods, but he should be a good organizer, manager and judge of men, both personally and intellectually. He must of necessity constitute the intermediary between the research staff and the commercial organization. It should be his first duty to try to be an inspiration to each man working in his department, always ready and available to discuss freely each man's special troubles and successes.

There are few persons who will not greatly appreciate helpful suggestions on the part of the director, and all will be encouraged if the director will only manifest a zealous interest in their work. A director full of enthusiasm and possessing an abundant supply of suggestions can work wonders in inspiring the men of his department to greater achievement. In fact, the director is the mainspring of the entire research laboratory, and the achievements of his men depend largely upon his leadership. By spending a few minutes each day or so with each investigator talking over problems and plans he can do much toward insuring a wide-awake department.

In order to carry on his investigations effectively, the man in charge must have enough assistants to do all his routine work, so that he can devote most of his time to planning the work, unraveling difficulties and considering the results obtained. Much very valuable time is lost by investigators in doing routine work which could be done just as well by younger, less experienced and less expensive men.

TECHNICAL LITERATURE INVALUABLE

It is quite important for the research man to have ready access to a good reference library in order that he may keep himself well informed upon matters pertaining to immediate and allied problems. This part of his work cannot receive too careful consideration. There are entirely too many instances where investigations are unnecessarily repeated because little attention was given to keeping well informed on the literature of the subject. It is little trouble for any research laboratory to have an excellent library of current scientific literature and standard reference books, but to supply technical literature issued long previous to its establishment is much more difficult and in many cases almost impossible.

Besides keeping himself well versed in the current literature of his subject, the research man must keep up his personal fellowship with as many men as possible who are working in his immediate field or in fields allied with it. He should attend the meetings of the scientific societies where topics of interest to him are presented and take part in their discussions. By so doing he will broaden himself wonderfully and obtain numerous ideas which will prove of unlimited value to him in conducting

his own work. No one can well avoid absorbing some of the enthusiasm manifested at such gatherings. One will at the same time gain useful information by getting the viewpoints of others.

INFLUENCE OF COMPENSATION

The question of compensation for research work is of no little importance. Some establishments adopt the policy of giving a monetary reward in the form of a bonus for achieving certain results such as patents and commercial applications. Others seem to act on the plan of paying only such salaries as are absolutely necessary to keep their men at work. Neither of these plans is the best one. The former, which depends upon results, will tend toward secrecy and destroy the very best element in research work. It hampers the influence of free and open discussion, which is by far the best means of promoting science, each person being able to profit by ideas gained from others. The second method leads to discontent on the part of the research man and in some cases causes him to take steps toward trying his fortunes elsewhere.

Financial recompense, however, is by no means the only reward sought by a research man. The honor obtained from having accomplished definite results for his company is much desired and should receive proper mention by those in authority. It is considerable satisfaction to the research man to realize that certain definite perplexing problems have been cleared up by his efforts and that he has added some specific results to scientific knowledge. Whenever a research man has done a piece of work that is of general scientific interest he should publish an account of it in the proper journal in order that the scientific world may give him the credit which he has earned.

Survey of Business Conditions

Radio Men in Conference Look for January Boom

Revival of public interest in radio and a consequent boom in the industry were predicted by radio broadcasters from various parts of the country who met at the Hotel Sherman, Chicago, on Oct. 16, to organize a National Broadcasters' Bureau for the protection of their interests. The gathering was somewhat startled by the straight-from-the-shoulder announcement that was made by George S. Walker, president of the Western Radio Corporation of Denver, that five thousand radio dealers are on the verge of bankruptcy and that something must be done to readjust conditions in the industry to save this small army of business men from the loss of their investment. This statement aroused the conferees to a realization of the situation in the industry and brought out an expression of belief that the first of the year would see a renewed interest in radio by the public and therefore the movement of radio supplies from the dealers' shelves.

Mr. Walker made it clear that he did not wish to be mistaken for a pessimist. He is convinced that the radio industry is destined to become one of the greatest commercial enterprises in the world, but he insisted that the proper type of men should steer the radio ship and that the industry as a whole and not selfish interests should be foremost in their minds.

It was decided to hold the second national radio show, which will be in the First Regiment Armory, Chicago, on Jan. 13 to 20, 1923.

Platinum Imports Increase

Total imports of platinum into the United States in July amounted to 11,421 ounces, exceeding February, the best previous month of the current year, by 397 ounces and comparing with an average for the preceding half-year of 6,797 ounces. Imports from Colombia in July were 3,442 ounces against 4,719 ounces in February, the best previous month in the current year, and compared with an average of 2,650 in the first six months. July imports from Esthonia, France, Sweden and England, that is, evidently of Russian origin, totaled 7,935 ounces more than in any other month this year, comparing with an average of 4,105 ounces in the previous six months. Other imports were from Spain and Cuba, 44 ounces.

Price remained at $90 until July 27, rising to $98 on Aug. 17 and to $108 on Aug. 28. Increased production in Colombia always follows a rise in prices. August, September and October may therefore be expected to have shown an increased supply. In the middle of October $112 was touched. The current price is around $102.

Argentina Developing Radio

Broadcasting of lectures, concerts and other matters of an educational and recreational nature in Argentina is covered by a concession granted to an Argentine engineer by the municipal government of Buenos Aires for the installation of wireless-telephone transmitting stations.

Portable Lamp and Fixture Business Improving

Business in portable lamps and fixtures in Boston is remarkably good, and one large house reports that almost its entire stock is now of very recent design owing to demands upon accumulated material. Residence lighting absorbs the principal sales. On some orders deliveries require four weeks to complete service. Prices are firm and less field soliciting is needed. Portable lamps are moving better than for many months, and stocks are being prepared for late holiday trade.

Sweden's Apparatus Market Suffering Depression

Conditions in the electrical apparatus and equipment industries are far from promising in Sweden at the present time, according to late reports from that country. The world-wide depression in connection with the loss of the Russian market and extremely severe German competition are primarily responsible for the prevailing depressed condition in the electrical and other industries of Sweden.

October Market for Poles Shows Little Change

The October market for poles in most parts of the country has changed but slightly from that existing in September. The freight-car shortage is still seriously affecting deliveries. Most of the present activity is to finish work on utility lines for the winter. Prices are firm and no changes have been placed on types of poles.

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0295	$0.0285	$0.0279
Cold finished shafting, per lb.	0.0378	0.0373	0.0379
Brass rods, per lb.	0.171	0.1700	0.148
Solder (half and half), per lb.	0.23	0.228	0.20
Cotton waste, per lb.	0.115	0.11	0.113
Washers, cast iron (⅛-in.), per 100 lb.	4.33	4.33	5.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.11	3.11	.....
Machine oil, per gal.	0.36	0.36	.....
Belting, leather, medium, off list	40-5@50%	40-5@50%	.....
Machine bolts, up to 1-in. x 30-in., off list	55@60%	50@65-10%	50@60-10%

Americans Procuring Much Business in Ceylon

Imports of electrical goods into Ceylon show an upward tendency in volume. American manufacturers are procuring their share in the increase, as the following table shows:

Year	Imports from United States	Total Imports
1913	$8,405	$238,409
1919	27,612	183,543
1920	49,112	373,875
1921	35,001	345,003

The United Kingdom has ranked first as a source of supply in all four years. German goods ranked second in 1913, but have not been imported in any quantities since. Japanese goods were second in 1919, but Japan has dropped out as a source of supply during the past two years. American-made goods were third in value in 1913 and 1919, but rose to second place in both 1920 and 1921. Imports from British India have risen in importance, so that that country now occupies third place. Imports from Italy in 1921 were also fairly large.

Electric Railroad Cars Built in 1921 Amounted to $14,856,068

During the year 1921 there were ten establishments in the United States engaged in the manufacture of electric railroad cars, and the total value of their products, according to government statistics just issued, was $14,856,068, as compared with seven establishments in 1919 with a total value of products of $18,441,976. This shows a decrease in the value of products of $3,585,908, or 19.4 per cent.

In 1921 there were 105 establishments engaged in the manufacture of steam railroad cars, and the total value of their products amounted to 314,394,867, as compared with ninety-nine establishments for 1919 with a total value of products of $538,222,831. The decrease in the total value of products was 223,827,964, or 41.6 per cent.

DETAILED STATISTICS OF ELECTRIC RAILROAD MANUFACTURING, 1921–1919

	1921	1919	Per Cent of Decrease
Number of establishments	10	7	....
Persons engaged	3,356	3,286	*2.1
Proprietors and firm members	.....	1	.....
Salaried employees	444	365	*21.6
Wage earners (average number)	2,912	2,920	0.3
Salaries and wages	$4,334,934	$4,984,941	13.0
Salaries	1,135,789	852,851	*33.2
Wages	3,199,145	4,132,090	22.6
Cost of materials	7,880,405	12,058,942	34.7
Value of products	14,856,068	18,441,976	19.4
Value added by manufacture	6,975,663	6,383,034	*9.3

* Increase.

The number of cars manufactured during the year by both classes of establishments showed a decrease from 155,186 in 1919, valued at $387,447,866, to 51,894 in 1921, valued at $180,866,191. The decrease was chiefly in the manufacture of steam railroad cars. This class showed in 1919 153,288 cars made, valued at $373,945,213, as compared with 50,361 cars, valued at $170,325,626, for 1921. The decrease in the number and value of cars manufactured was 67.1 and 54.5 per cent, respectively.

These figures do not include the number and value of cars manufactured in repair shops of steam and electric railroad companies or as secondary products by establishments classified in other industries.

Prevailing Conditions Affecting Cost and Volume

Demand for Freight Cars.—Demand for freight cars in excess of the current supply amounted to 141,252 cars on Oct. 8, according to reports just filed by the carriers with the car service division of the American Railway Association. This was an increase of 10,927 cars over the total on Sept. 30. Shortage of box cars amounted to 71,063, an increase in eight days of 4,534, while for coal cars it amounted to 40,499, an increase in the same period of 1,545.

Loading of Revenue Freight.—Loading of all classes of revenue freight totaled 968,169 cars during the week which ended on Oct. 7, according to reports just filed by the railroads with the American Railway Association. This was an increase of 68,488 cars over the corresponding week of 1921, but a decrease of 43,497 cars under the corresponding week in 1920

Failures.—Increases in all sections of the United States, but especially in the East, have raised the total for last week's failures to 442, as compared with the 390 defaults reported to R. G. Dun & Company for the five-day period last week. For the corresponding week in 1921 the total was 407.

Commodity Prices.—Although changes have been somewhat less numerous, the upward trend of wholesale commodity prices continues unabated, fifty-eight advances appearing in the 338 quotations received last week against twenty-eight recessions.

Bank Clearings.—Returns of bank clearings last week make a more favorable exhibit than has been noted for some time past, an aggregate of $8,515,400,000 at twenty cities in the United States, as reported to *Dun's Review*, representing an increase of 22.2 per cent over the total of a year ago and being 1.9 per cent in excess of the figures for this period of 1920.

Volume of Business.—Volume of business for the week ended Oct. 18 was $9,865,000,000, compared with $9,319,000,000 for the week before. This increase of 6 per cent is reported in spite of the fact that the week of Oct. 18 includes Columbus Day, which is observed as a holiday in most of the cities. Larger figures are shown for all the leading centers, except Pittsburgh and San Francisco.

The Metal Market

Some Larger Copper Producers Continue to Quote 14 Cents, Delivered —Others Meeting Competition

Some of the larger producers are continuing to quote 14 cents delivered, but little if any business has been done on this basis since last Saturday. Others are meeting the competition of those producers whose policy provides for marketing steadily their current output. In the last three or four days the price of 13⅞ cents delivered has been so common that it has been necessary to go even below this to attract purchasers, and several orders of fairly large size have been placed at 13.75 cents delivered. The amount of copper to be obtained at this price shows indications of being limited, however, and consumers generally are finding it a difficult matter to obtain copper for less than 13⅞ cents.

The decline in price is attributed entirely to the apathy of consumers. They are operating their plants to capacity, so some other reason must be assigned for the sudden lull in demand. Possibly the chief reason is the freight embargo. Whereas it ordinarily may take one week to ship from refinery to consumers' destination, it now takes three or four weeks, and the consumer is more interested in getting material in and out of his plant just now than in buying more raw materials. He has not forgotten the 1920 tie-up.

Export business continues quiet at prices which net producers figure not far from that realized on domestic business. Sales of lead have not been so large as last week, but producers have little to offer, and there has been no sign of a slump in price. Lead for prompt delivery is virtually unobtainable in the New York market except in small quantities from dealers who are asking up to 6.75 cents for it. With the St. Louis market firm at 6.30 cents, shipment from there could not be arranged under 6.65 cents, New York, so a slight premium on the smelting company's price is not unreasonable. There was some effort in St. Louis to obtain 6.35 cents for lead, but consumers were not particularly attracted by this price, and the basis of actual business has gradually returned to 6.30 cents. Embargoes are affecting the lead market, being troublesome alike to producers and consumers.

NEW YORK METAL MARKET PRICES

	Oct. 18, 1922 Cents per Pound	Oct. 25, 1922 Cents per Pound
Copper		
Prime Lake	14.00	14.00
Electrolytic	14.00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price	5.75	5.75
Antimony	5.25	5.25
Nickel, ingot	36.00	36.00
Zinc, spot	6.50	6.50
Tin, Straits	32.20	32.20
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	11.00–11.25	11.00–11.25
Brass, heavy	5.75– 6.25	5.75– 6.25
Brass, light	5.25– 5.50	5.25– 5.50
Lead, heavy	4.62½–4.75	4.62½–4.75
Zinc, old scrap	3.00– 3.37½	3.00– 3.37½

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

STEADY demand continues in the electrical market, reports from all over the United States indicate. Central-station business is improving. Prices are firm, but some advances in the near future are expected. Heaters are selling satisfactorily, and the trade is optimistic about the future. Conduit is again becoming scarce in the Western States owing to the heavy amount of construction work. The radio trade is far from being satisfied with sales, but hangs on with optimism. Motors are slower than two weeks ago. Fixtures are in fair demand.

New York

Business Steady—Heaters Feature of Market—Socket Sales Improving —Radio Prices Lower

Electrical business during the last week was steady, jobbers and manufacturers reporting an even demand and little stiffening or lowering in prices. Heaters continue to be a feature of the market. Stocks of these are reported adequate to meet present requirements.

Motors.—Demand for motors is not so strong as during two weeks ago. Stocks are large and prices are firm. Second-hand dealers are receiving most of the business.

Sockets.—Sales are improving, and another increase in price in the near future is expected.

Storage Batteries.—Fair demand is reported, prices are firm and stocks are ample for present requirements.

Radio.—Dealers state that sales are improving each week but are not so strong as were expected. Prices generally are much lower than those of last year.

Chicago

Conduit Stocks Still Low—Pole Market Unchanged—Brisk Appliance Sales—Wire Improves

With a continuing unprecedented building construction in this territory requiring a good volume of wiring material, the largest snag in the path is the low stocks of conduit. Shipments from manufacturers come through fairly well, but a car shortage is seriously affecting the situation. The same cause is preventing utilities from finishing the rehabilitation of their pole lines before winter. The local demand for heating appliances, such as open air heaters, toasters and percolators, is active. The call for high-tension equipment remains steady.

Conduit.—Demand continues steadily, but most stocks are low. Prices on the ½-in. black pipe range between $55 and $57 per 1,000 ft. in 5,000-ft. lots.

Wire.—Prices are tending upward, since several dealers are quoting the No. 14 rubber-covered wire at $6.35 and $6.40 per 1,000 ft. in 5,000-ft. lots, according to conditions of sale. Stocks are fair but not excessive, since the call still remains active.

High-Tension Equipment.—Manufacturers continue to report a healthy volume of business. One firm this week filled orders for four 1,000-kva., 33,000-volt outdoor substations to be located in the Middle West and one 3,000-kva., 66,000-volt substation for a Southwestern utility.

Heating Appliances.—Fall trade is continuing quite briskly on standard lines such as open air heaters, toasters, tables stoves and percolators. Return of fall weather has started an active call for air heaters and dealers have ample stocks.

Boston

Conduit Stocks Are Uneven—Weatherproof Wire Quiet—Fair Demand for Cleaners Reported

The tide of business is rising in electrical lines from week to week. Jobbers' stocks are considerably depleted, with much unevenness in steel products. Electrical manufacturers are rapidly increasing their outputs, and general trade is improving. Contractor-dealer finances are causing some inconvenience, both in Massachusetts and Connecticut. Price-cutting is giving less trouble since the recent advance in sockets. Building contracts in New England sagged off a little last week. Central-station outputs and merchandise sales continue to show substantial gains over last year. Deliveries are hampered in some quarters by car shortages.

Rigid Conduit.—Stocks are very uneven, and shopping around among jobbers is frequent to fill out orders. Prices are firm, with upward tendencies.

Wire.—Weatherproof wire is quiet, but rubber-covered is moving well. Radio aërial demand is picking up a little on bare copper.

Flexible Armored Conductor.—Sales are active, No. 14 single-strip moving around $44.20 per 1,000 ft. in 5,000-ft. lots. Inside wiring improvement is reflected in local trade.

Radio Equipment.—The market improves from week to week, with spreading demand for low-cost and higher-priced sets. Deliveries are in fine shape. Improved equipment is going into the broadcasting installations, and this stimulates retail sales.

Appliances.—Vigorous sales efforts are yielding better results in the washing-machine field, and there is a fair demand for cleaners. Irons continue to sell steadily, and the current month has seen good business in hollow ware for wedding presents. Radiators are moving better and toasters are responding to well-directed advertising and personal sales efforts.

Motors.—Business is improving, and gains over earlier months this year are being well sustained. Deliveries are in excellent shape and prices are firm. Smaller units are in chief demand.

St. Louis

Socket Business Satisfactory—Safety Switches in Demand—Lamp Cord Inactive and Spotty

Agricultural conditions continue promising. Movement of cotton and amount in sight are slightly greater than last year and very much more than in 1919 and 1920. Carload shipments of fruits and vegetables to Oct. 1 were considerably above the amount of 1921. Recent rain has put the ground in good shape for winter wheat. Cattle prices are about average, but hogs and sheep are very low. Industrial plants are increasingly active, the general average of operations being apparently about 80 per cent of plant capacity on normal time basis.

Sockets.—Business in this line is very satisfactory, considering demand, stocks and prices. Representative quotations in standard package lots, f.o.b. St. Louis, are, per 100: Key, $18.15; keyless, $16.50; pull, $33; pendent porcelain key. $25.50; pendent porcelain keyless, $23; mica weatherproof, $9; composion weatherproof, $9.65; porcelain weatherproof, $9.90.

Safety Switches.—A very attractive demand exists, as virtually all local industrial switch installations are now of the safety type. One make of 250-volt bottom-fused switch is priced as follows: 30-amp., two-pole, $3.38 each; 30-amp., three-pole, $4.50 each; 60-amp., two-pole, $5.62 each; 60-amp., three-pole, $6.19 each; 100-amp., two-pole, $7.88 each; 100-amp., three-pole, $9.75 each. A 30-amp., 125-volt, two-wire entrance switch is quoted at $1.25 each, or $100 for 100.

Fuses.—The seasonal increase in demand for plug fuses is being felt and stocks are in healthy condition. Prices are firm on the following basis: Less than 100, $3.50 per 100; 100 to 499, $3 per 100; 500 or more, $2.75 per 100. Cartridge fuses, 0-amp. to 30-amp., are quoted at $5.20 per 100, and 31-amp. to 60-amp. at $7.80 per 100.

Lamp Cord.—In 1,000-ft. lots the following prices obtain per 1,000 ft: No. 18 twisted cotton, $11.50; No. 16 twisted cotton, $15.23; No. 14 twisted cotton, $23.02; No. 18 twisted silk, $24; No. 18 parallel silk, $26; No. 18 parallel cotton, $13.72. Demand is inactive on all lamp cord.

Atlanta

Lamp Cord Sales Are Good—Flatiron Price Reduced 10 per Cent —Washers Slow

Inclement weather for the past week has interfered with the picking of cotton and the harvesting of other agricultural products. It has also tended to slow up business generally. All of the larger rural county seats have held fairs during the past fortnight, and merchants are expecting this to stimulate the sale of farm implements, while money spent by visitors will serve to assist in the payment of debts by local merchants. Electrical business, as a whole, is reported very good with prospects for a brilliant finish for 1922.

Lamp Cord.—Sales are very good, stimulated somewhat by difficulty in obtaining fixtures on account of freight congestion. Local dealers' stocks are good with deliveries fair.

Flatirons.—Ten per cent reduction in price is to be noted, with sales better than for some time. Stocks are in good shape and shipments satisfactory.

Safety Switches.—Former activity in this line continues, showing healthy increases from month to month with the 30-amp. to 60-amp., 250-volt types in most demand.

Oil-Engine Generator Sets.—Renewed activity has manifested itself, and a number of very satisfactory sales have been recently reported. Stocks are low, with shipments listed at from four to six weeks.

Farm-Lighting Outfits.—Renewed interest is being displayed, with the largest jobbers anticipating a considerable improvement in volume of sales for this year over last.

Washing Machines.—Washing machines occupy a position similar to sewing machines, and efforts to revive interest seem of little avail. Prices are steady and stocks heavy.

San Francisco

Insulating-Material Stocks Are High—Sewing-Machine Sales Show Spurt—Cleaners Active

Establishment of competing branches of several savings banks is evidence of the restoration of retail prosperity and retail activity in outlying city districts which will profoundly affect Christmas buying. Retail sales showed nearly 30 per cent increase for September over August.

Radio.—The industry expects the early establishment of excellent new broadcasting stations.

Insulating Material.—During spring certain insulating materials were quite depleted by the sudden radio boom, but heavy reorders were not quite matched by the decreasing demand, so that local stocks are high. These lines are now carried quite universally, and no longer may any particular jobber or dealer be considered as exclusive headquarters.

Household Appliances.—Exhibitors at fairs and industrial shows report great interest and long lists of prospects, yet the same territories have been considered pretty well saturated by selling crews. Washers and vacuum-cleaners sales have been very good. Sewing-machine sales are showing a spurt which is attributed to the regular fall demand. Buying has been late for Christmas. Table appliances are in demand.

Denver

Demand for Conduit, Wiring Devices and Fixtures Holding Up Strong—Radio Improving

Building permits in Denver passed the million-dollar mark last week, establishing a record for the half month. Demand for wire, conduit, wiring devices and lighting fixtures is holding up strong. Transportation difficulties are retarding supply of many staple items. Jobbers report good business with holiday activity under way.

Radio.—Local jobbers have formed radio organization and all agree that radio business is improving, especially the sale of higher-priced sets. Slow movement in complete crystal sets, but demand for parts is increasing.

Motors.—Gradual improvement in inquiries and sales, with stocks being replenished by jobbers and agents.

Conduit.—Prices are firm, but increase is anticipated because of demand being greater than supply. All jobbers are anticipating requirements for next four months. Orders covering this period have already been placed. Prospects on deliveries are poor.

Wire.—Slight increase announced on several wire accounts with prospects of sharp raise shortly, according to several jobbers. Warehouse stocks still holding up.

Schedule Material.—Heavy demand with rising prices. Local stocks in good shape.

Cleveland

Radio Sales Gaining—Dealers Stocking Shelves with Appliances—Small Motors in Demand

While no great activity has occurred in any line save the heaters, receipts have been wholly satisfactory. Other industries are settling down with the adjustment of labor and rail difficulties. All this has an invigorating effect on things electrical, and it is anticipated by manufacturers, jobbers and dealers that an active fall season will prevail. Building continues to indicate that the operations through the fall months will be of sufficient volume to insure employment for the various crafts engaged in construction, and electrical sales will necessarily be in proportion.

Radio Equipment.—Sales have gained steadily, and while the upward curve has not been especially pronounced this week a comparison with last month shows that the expected resumption of activity has started, and dealers assert that it will develop into an active season.

Appliances.—Dealers are continuing to stock their shelves to meet the anticipated holiday demand. Jobbers are not experiencing any difficulty in supplying them, however. Current sales are good.

Motors.—The season for motors is well under way, with each week bringing increased activity. Demand for the smaller absorbs the supply easily.

Portland–Seattle

Business Conditions Good—Lively Demand for Pole-Line Material —Conduit Shortage Continues

Business conditions are reported good. Production of lumber continues to be above normal, but new business is falling off. Car shortage has seriously affected lumber shipments. It is reported that more than 50 per cent of the shingle mills of the Northwest have been compelled to close because of lack of shipping facilities. Forunately sufficient refrigerator cars have been diverted; to fruit shippers to save the apple crop.

Electrical jobbers report business very good. There is a lively demand for pole-line material. Many high-tension transmission lines are in course of construction throughout this section.

Farm-Lighting Plants.—These plants are becoming active as a result of demonstrations and exhibits at county fairs throughout the territory.

Conduit.—The shortage continues with little hope for material improvement, as back orders are accumulating to such an extent that they will absorb the greater part of the new shipments as they arrive. Prices generally are stiffening, although quotations on knobs, tubes and cleats remain unchanged.

Salt Lake City

Electrical Contractors Busier than Ever Before—Wire Demand Is Good—Price Advances

Electrical contractors are busier than they have been for several years. There is an actual shortage of electricians at the present time. The demand is occasioned by a number of big construction jobs recently begun and by a persistent home-building campaign. Dealers are stocking much better than they did at this season a year ago.

Pole Line Hardware.—A dearth of line construction keeps the demand at low ebb. The trend is toward improvement.

Panelboards.—There is some activity, but it is spotty. One large factory reports good production, but the general condition is not promising.

Conduit.—A serious shortage is reported by jobbers. There has been a recent sharp upward turn in the price schedule.

Wire.—The demand is good. A price increase amounting to 5 per cent went into effect this week. Stocks are in fair condition.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Appoint Reorganization Body for Habirshaw Cable Companies

At a meeting of the committees representing the debenture holders, note holders and general creditors of the Habirshaw Electric Cable Companies Affiliated held Oct. 17, at which upward of 80 per cent of the respective interests were represented, reports of experts retained by the committee to advise on the business prospects of the companies upon reorganization and the amount of new capital required to effect a reorganization on a sound financial basis were carefully considered.

To facilitate an early reorganization of the properties the respective committees appointed a reorganization committee of five in which full power was vested to proceed with the least possible delay. This committee consists of E. A. Potter, Jr., vice-president of the Guaranty Trust Company; E. N. Potter, of Potter Brothers & Company; F. J. Leary, vice-president of the Central Union Trust Company; T. K. Stevenson of the Western Electric Company, and T. E. Quisenberry, of Howe, Quisenberry & Company, Chicago.

The committee on reorganization will devote its immediate attention to the final details of the plan of reorganization and the requisite financing.

Electric & Radio Supply Company Formed Following Receivership

The Electric & Radio Supply Company, 165 North Wells Street, Chicago, has been formed by John F. Bowbin and F. J. Fencl following the receivership in July of the Columbia Light Company. This new company, which is a partnership, will continue to act as jobber and distributor of electrical supplies, including lighting fixtures and radio. About 5,000 sq. ft. of floor space is now in use. John F. Bowbin brings to this company thirty years of experience gained in the electrical supply business. He was formerly connected with the Electric Appliance Company for twelve years and with the Manhattan Electric Company eighteen years. His partner, Mr. Fencl, has spent twelve years in the industry.

Syracuse Washing-Machine Firm Opens Connecticut Office

The Syracuse Washing Machine Company, manufacturer of the "Easy" washer, has established a sales office at 352 Asylum Street, Hartford, Conn., under the name of the Syracuse Washing Machine Sales Company, Inc.

H. W. Karstens, formerly of the H. W. Karstens Sales Company, Hartford, has been appointed manager. Two men have been placed upon the road to handle Connecticut wholesale business, and F. B. Moore, formerly with the Columbus (Ohio) office of the organization, has joined the Hartford staff. Both wholesale and retail distribution will henceforth be handled for Connecticut from this office.

Electric Machine Corporation's Order to South Africa

The Electric Machine Corporation, Indianapolis, recently has shipped a large order of radio apparatus to South Africa. Its sales force has been enlarged to six men, who are traveling through the Middle Western territory. The company moved to its new building in May, where 12,000 sq.ft. of floor space is now in use.

Societies Combine to Make Fixture Market a Success

Three electrical societies have combined forces in an effort to make the January convention of the fixture market a success. At a meeting of the executive boards of the Lighting Fixture Dealers' Society of America, the National Council of Lighting Fixture Manufacturers and the Illuminating Glassware Guild, held at Hotel Winton on Oct. 10 and 11, it was decided that henceforth there would exist closer co-ordination of the societies, which would work to the greater expansion of the fixture market.

It was also announced at this session that the convention would be held at the Hotel Winton at Cleveland the week of Jan. 15. The manufacturers' regular business sessions have been postponed to the midsummer meeting so as to leave the entire week of Jan. 15 to conduct the business sessions of the dealers. Inasmuch as the 1923 convention and market will not be open to the public, it was decided that exhibits in hotel rooms would be more satisfactory than the open booths in a public auditorium used at previous markets. It is the opinion of the executive boards also that the business atmosphere of a hotel is more conducive to a successful market than that of the auditorium.

A feature of the convention, which will include a display of glassware and lighting fixtures, will be practical demonstrations of the proper approach of dealer to retail customer and of salesman to dealer. Five hundred dealers and 2,500 salesmen are expected to attend. Officials will concentrate on a membership drive and manufacturers will have an opportunity to discuss the industry with the dealers.

Norma Firm Acquires American Patents of English Company

The Norma Company of America, Anable Avenue, Long Island City, N. Y., has acquired the American patents and business of the Hoffmann Manufacturing Company, Chelmsford, Essex, England, makers of "Hoffmann" roller, ball and thrust bearings. The line of "Norma" precision ball bearings will now be supplemented with "Hoffmann" precision roller bearings and other bearing products in the "Hoffmann" line.

During the past year the Norma company has thoroughly investigated the American market for roller bearings of this high quality and has found a distinct demand for high-grade units of roller type, interchangeable as to dimensions with standard ball bearings but having a much greater load capacity.

The Norma company will erect a new plant for the manufacture of "Hoffmann" products in America. Meantime, they are being imported and sold under the regular "Norma" engineering service.

Westinghouse Opens Minneapolis Sales and Service Building

In order to serve adequately the territory known as the Twin City area, the Westinghouse Electric & Manufacturing Company has leased a six-story building in the Minneapolis industrial district which will serve as a combined sales, service and warehouse center. The structure, which was built especially for and is leased by the Westinghouse company for a period of twenty years, is one of a group of buildings included in the plan of the Northwestern Terminal Company of Minneapolis to provide an efficient and economical distributing service for the products of Eastern manufacturers.

The building, which houses the Westinghouse Electric & Manufacturing Company and the Westinghouse Lamp Company, is five stories above ground with one story underground. The top three floors are duplicate in arrangement and will be used for warehousing purposes. The material is carried to these floors by means of a 6,000-lb. elevator which can receive goods either from the loading platform, which is on the level of the first floor, or from the tunnel, which leads from the basement. The warehouse floors are 80 ft. by 100 ft. This gives a floor space of 8,000 sq.ft. each, or 24,000 sq.ft. for the three upper floors. The second floor contains the telephone switchboard and reception room and the offices for the Westinghouse Electric & Manufacturing Company and the Westinghouse Lamp Company.

A complete and entirely up-to-date service department for the repair of apparatus will be installed on the first floor. In this department all work previously jobbed through concerns in Minneapolis and that sent to the service station at Chicago will be cared for. The service department will be entirely

modern, the machines being equipped with direct-connected motors. There will also be a shipping department on this floor, a band saw, a cut-off saw and a rip saw being available for shaping up the wood for shipping purposes.

Shipment from stock direct through the Northwest territory, which, of course, will be a great advantage for less than carload lots, will mean a considerable saving in time for the customer. For instance, a shipment from Chicago stock to Fargo, N. D., which would probably take from two to three weeks, will now be done in three days after receipt of the order in Minneapolis. With a stock ultimately amounting to a million dollars, all ordinary requirements will be taken care of for North Dakota, South Dakota, Minnesota and the northeastern section of Wisconsin. The Lamp company will maintain an emergency stock which can be replenished by Indianapolis or Milwaukee within two or three weeks, thus providing an improved service for the Northwestern district.

McGregor Battery Engineering to Construct Plant Soon

The McGregor Battery Engineering Company, 681 Marshall Avenue, Memphis, Tenn., will soon break ground for the construction of a one-story plant, 30 ft. x 105 ft., at 678 Monroe Avenue for battery manufacture and repair.

Stewart Electric Motor Company Plans to Rebuild Works

The S. J. Stewart Electric Motor Company, New Orleans, has tentative plans under consideration for rebuilding its works at 527-531 St. Joseph Street, partly destroyed by fire Oct. 14, with loss approximately $60,000, including equipment and building. The stock at the plant, valued at $125,000, sustained a heavy additional loss.

Johns-Pratt Company Appoints G. W. Mapother Sales Manager

The Johns-Pratt Company, Hartford, Conn., manufacturer of fuses and protective devices, announces the appointment of George W. Mapother as the district sales manager for the electrical division in New York City. Mr. Mapother will make his headquarters at the New York office of the company, at 41 East Forty-second Street.

The General Electric Company, Schenectady, N. Y., has awarded a contract to the Austin Company, Bulletin Building, Philadelphia, for the construction of a one-story building at its local works, 100 ft. x 340 ft., estimated to cost about $120,000. Contract has also been let to the Foundation Company, 120 Liberty Street, New York, for the construction of its proposed branch plant at Oakland, Cal., consisting of a main one-story building, 100 ft. x 300 ft., to cost approximately $110,000.

Formica Insulation Company Holds Annual Sales Meeting

Announcement was made at the annual sales meeting of the Formica Insulation Company at Cincinnati, Sept. 12 and 13, that the growing demand for "formica" for all sorts of electrical and mechanical uses had made it necessary to double the capacity of the plant during the past year. This increased capacity has put the company in a position where it can now deliver moderate quantities of formica in standard shapes and sizes the same day the order is received.

At the sales meeting the company's entire sales organization was present, the Atlantic and Pacific Coasts and all the territory in between being represented. Each representative reported on conditions in his territory, and all of them expressed confidence that the coming year would be the greatest in the history of the Formica company.

In addition to the general electrical manufacturing business, formica has a large business in the automotive field, both for insulating purposes and for non-metallic timing gears. It has a large gear business with the industrial gear cutters. Formica is also coming to be used extensively for pump valves in the oil industry, the packing industry and others where large numbers of pumps are employed.

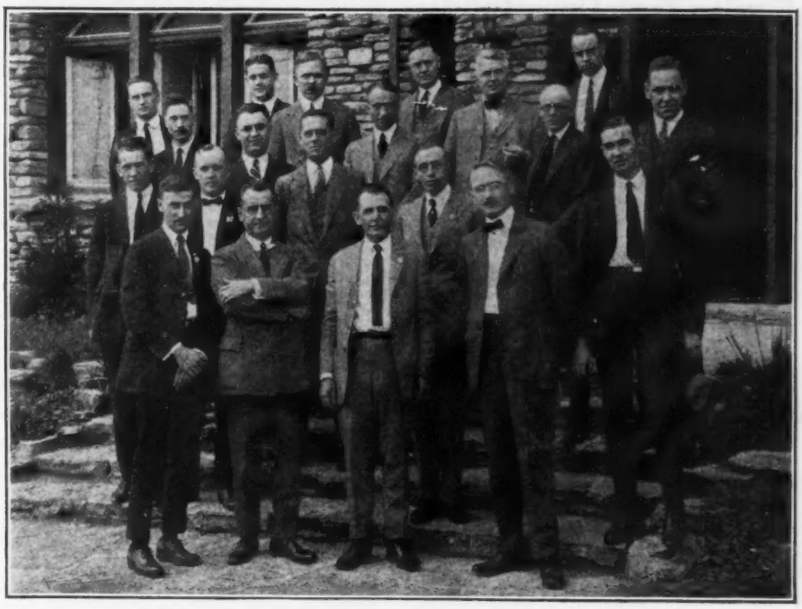
One of the prime reasons for the sales meeting was the announcement and discussion of the advertising campaign planned for the company during the next twelve months. The sessions were held in "Advertisers' Hall" at the new building of the Procter & Collier Company, the Formica advertising agency.

The advertising campaign for the next year will be the greatest that has ever been undertaken for laminated phenolic insulation products. It will cover every field in which the material is sold and will combine strong publication advertising with intensive direct by mail work.

The meeting was under the direction of D. J. O'Conor, who directs the marketing, and an address was made by Mr. Faber, the financial officer and mechanical engineer of the company.

One of the speakers was Dr. L. V. Redman of the Redmanol Company of Chicago, which has supplied the phenolic resins from which formica is made. He explained the raw-material situation and discussed new raw materials and the possibilities of using them.

The speakers at the meeting included Allen Collier of the Procter & Collier Company; Mr. Ryerson, Formica representative of New York City; Mr. Morell, Cleveland; Mr. Montfort, specialist in automotive sales, Chicago; Mr. Steinberger, Chicago; Mr. Hill, Philadelphia; Mr. Bittner, Pittsburgh; Mr. Wolcott, Rochester; Mr. Hermans, San Francisco, and Messrs. Moll, Calhoun and Steiner of the Procter & Collier Company's service staff.



ANNUAL SALES MEETING OF FORMICA INSULATION COMPANY

Says Appliances Need Suffer No Seasonal Slump in Summer

The P. A. Geier Company, Cleveland, Ohio, declares that the results of its recent midsummer sales contest prove that the retail electric appliance business need suffer no seasonal slump in the summer months. The usual slack period at that time has been due simply to a belief that such condition was inevitable, in the opinion of General Manager F. J. Gottron, who is now announcing a second campaign. In this new competition, timed for the best selling season of the year, thirty-three cash awards will be given, totaling $5,360, and in addition a "Royal" cleaner will be presented free to every man who sells twenty-five machines between Oct. 23 and Dec. 23.

Foreign Trade Notes

EXTENSIONS TO ELECTRIC SYSTEM AT DAIREN, MANCHURIA, CHINA.—The proposed extensions to the electric system in South Manchuria, China, according to *Commerce Reports*, include a transformer station at Shakako, additions to the power plant at Changchun, erection of service stations at Dairen, Mukden and Antung, and extensions to the street-railway system in Darien. Work will also be continued on the construction of power house No. 3 at Antung.

ELECTRIC TRAVELING CRANES FOR EGYPT.—Tenders will be received by the Administration of Ports and Lighthouses, Alexandria, Egypt, according to the *Electrical Times*, until Dec. 20 for eight traveling electric quay cranes, eight traveling cranes, eight electric lifts, rails, etc.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase and sole agency is desired in Norway (No. 4,009) from manufacturers for electrical supplies.

An exclusive agency is desired in Cuba (No. 4,021) for electric bulbs and other accessories for automobiles.

An agency is desired in Greece (No. 4,026) for electrical supplies, heating equipment, oil engine from 10 hp. to 150 hp., etc.

Purchase is desired by a firm in Canada (No. 4,038) for equipment for a 1,200-hp. hydro-electric plant.

An agency and purchase is desired in Australia (No. 4,045) for vacuum cleaners, etc.

An agency is desired in South Africa (No. 4,053) for electrical supplies, such as heater appliances, motor appliances, special instruments, pole-line material, lighting fixtures, glassware, bells, annunciators, fans and specialties.

Purchase is desired in Argentina (No. 4,057) for complete radio receiving and sending sets for installation on trains.

New Apparatus and Publications

PROTECTION FOR FEEDER SECTIONS.—A new automatic sectionalizing contactor for railway and mining use has recently been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

DIESEL ENGINES.—The Busch-Sulzer Brothers—Diesel Engine Company, St. Louis, is distributing a leaflet showing illustrations of various installations of the Busch-Sulzer Diesel engines.

NON-SCALING FLASH EVAPORATOR.—The Schutte & Koerting Company, Philadelphia, has recently developed a new non-scaling flash evaporator for the production of pure boiler-feed water.

AUTOMATIC SERIES CUTOUTS.—The States Company, 72 Francis Avenue, Hartford, Conn., has issued Catalog No. 3, Section 2, describing its automatic series cutout for series street-lighting circuits.

FLOOR COVERING.—"Carborundum Anti-Slip Tile" is the title of a booklet distributed by the American Abrasive Metals Company, 50 Church Street, New York City, sales representative of the Carborundum Company, Niagara Falls, N. Y., describing the "Carborundum Anti-Slip" tile for stair treads, elevator landings, factory and general floor surfaces.

CHAIN HOIST—An electrically driven chain hoist, known as "Motorbloc," has been placed on the market by the Motorbloc Corporation, Summerdale, Philadelphia.

MOTORS.—The Century Electric Company, St. Louis, is distributing bulletins Nos. 28, 30 and 31, describing its large and small polyphase and split-phase motors.

POWER-TRANSMISSION EQUIPMENT.—The Link-Belt Company, 910 South Michigan Avenue, Chicago, has issued a new general catalog No. 400. It contains 832 pages and covers the entire line of its products.

CIRCULAR SLIDE RULE.—The Pittsburgh Electric Furnace Company, Pittsburgh, has brought out a circular slide rule, known as the "Lectromelt" calculator, for calculating the additions of various alloys and various metal mixtures to allow any given percentage of alloy. This device is intended for the aid of the furnace superintendent and melter in the foundry and the metallurgical industry generally.

STEEL CABINETS.—The Electric Motor & Engineering Company, Canton, Ohio, is distributing catalog No. 3, section 4, covering its new line of steel-guttered cabinets.

STOKER.—Bulletin CB1 issued by the Combustion Engineering Corporation, 43 Broad Street, New York City, describes the "Coxe" stoker and covers particularly the performance of this stoker on Western and Mid-Western bituminous coal. The company is also distributing a small booklet entitled "Service" which defines the meaning of this term from the standpoint of the stoker mnufacturer.

PANELS AND SUPPORTING FRAMEWORK.—"Switchboard Panels and Supporting Framework" is the title of bulletin No. 47,002, issued by the General Electric Company, Schenectady, N. Y., covering its vertical and bench types of switchboard panels.

TRUCKS.—The Barrett-Cravens Company, 169 North Ann Street, Chicago, is distributing a booklet describing the various types of the Barrett "lift-trucks" for use in industrial plants. The company is also distributing leaflets covering the Barrett "Never-Slip" cranes, "Steeleg" platform, barrel trucks, and the Barrett "lift-trucks" equipped as trailers.

RUSTLESS STEEL.—The Pyrene Manufacturing Company, 520 Belmont Avenue, New York City, is distributing bulletin No. 3, calling attention to "Parkerized" steel, the Parker process of making steel rustproof.

LIGHTING FIXTURES.—The Crescent Brass Products Company, 8410-12 Lake Avenue, Cleveland, is distributing catalog No. 6, covering its various types of lighting fixtures.

ELECTRIC FURNACE.—The Pittsburgh Electric Furnace Corporation, Pittsburgh, Pa., is distributing a leaflet describing the Moore rapid "'Lectromelt" furnace.

TEMPERATURE CONTROLLERS.—The Foxboro Company, Inc., Foxboro, Mass., has published bulletin No. 112-1, covering the "Foxboro" automatic temperature controllers. The company is also distributing a leaflet describing its automatic temperature or pressure recorder-controller with pneumatic switch.

CHART.—The Martindale Electric Company, Box 35, Station C, Cleveland, has issued a chart showing causes and effects of carbon brush and commutator troubles.

INDUSTRIAL TRACTORS.—"How to Calculate the Work That May Be Expected from an Industrial Tractor" is the title of the leading article in the September issue of the *Trackless Train*, issued by the Mercury Manufacturing Company, 4118 South Halsted Street, Chicago.

ENGINES.—Bulletin No. 1,001, issued by the Climax Engineering Company, Clinton, Iowa, gives illustrations of various installations of "Climax" engines in contractors' machinery.

ELECTRIC TRAMWAY FOR SAN JOSE, GUATEMALA, CENTRAL AMERICA.—A concession has been granted by the Ministry of Promotion to a foreign company, recently organized with a capital stock of $2,000,000, to operate an electric tramway of not less than 9 miles in length in the town of San José, Guatemala. The company is also given permission to extend the railway beyond the city limits to Chimaltenango and Sacatopéquez within two years. The concession stipulates that the overhead trolley system shall not be used.

New Incorporations

THE SANDY RUN ELECTRIC COMPANY, Mooresboro, N. C., has been incorporated with a capital stock of $50,000 to supply electricity in Ellenboro, Latimore, Mooresboro and Boiling Springs. The officers are C. F. Gold, Ellenboro, president, and L. Hmarick, Latimore, secretary and treasurer.

THE LACROSSE (VA.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $5,000 to furnish electricity for lamps and motors in Brunswick and Mecklenburg Counties. The officers are O. F. Northington, president, and E. D. Nash, secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

HAMPDEN, ME.—The Public Utilities Commission has granted the Hampden & Newburg Light & Power Company permission to furnish electricity in certain portions of Hampden and in the towns of Newburg and Dixmont.

SUNAPEE, N. H.—Work has been started by the Lake Sunapee Power Company on the construction of a large hydro-electric power project at Sunapee Harbor. The plans call for a new dam and a steel penstock. The cost is estimated at about $300,000. I. M. Frost, Rutland, Vt., is president; C. C. Main, 201 Devonshire Street, Boston, is engineer.

VERGENNES, VT.—The Vergennes Electric Company contemplates extending its transmission line from Shelburne, 2½ miles, to furnish electricity to farmers in that district.

BOSTON, MASS.—The Edison Electric Illuminating Company has applied to the Public Service Commission for permission to issue $5,406,700 in capital stock, part of the proceeds to be used for a new power plant, extensions and improvements.

Middle Atlantic States

HUNTINGTON, N. Y.—Electric power equipment will be installed in connection with the proposed two-story incinerating plant, 70 ft. x 100 ft., to be constructed by the Bureau of Public Works. Joseph P. Powers, Rockaway Beach, is architect.

JOHNSON CITY, N. Y.—The Binghamton Light, Heat & Power Company will build a two-story addition to its power house at Willow Point, cost about $75,000.

KINGSTON, N. Y.—Contract has been awarded by the Uister & Delaware Railroad Company for the construction of an addition to the power house and boiler room adjoining the shops on the East Strand to the Michaud-Campbell Company, Inc., Kingston.

LITTLE FALLS, N. Y.—The Adirondack Power & Light Company, Amsterdam, has petitioned the Public Service Commission for permission to operate an electric transmission line in Little Falls and Schuyler.

SALISBURY, N. Y.—The Utica (N. Y.) Gas & Electric Company has applied to the Public Service Commission for permission to operate an electric transmission and distribution line in Salisbury.

SYRACUSE, N. Y.—The Chamber of Commerce has passed a resolution asking the City Council to adopt a uniform system of street lighting throughout the city.

PRINCETON, N. J.—The Public Service Electric Company will build a transmission line from Princeton to Hightstown, N. J.

CHESTER, PA.—The proposed plant to be erected in Chester by the Stauffer Chemical Company, 624 California Street, San Francisco, to cost about $500,000, will include a power plant.

CORAOPOLIS, PA.—The Vulcan Refining Company contemplates erecting a power house, one-story, 56 ft. x 60 ft. E. C. Dilworth, Walsh Building, is consulting engineer.

HARRISBURG, PA.—The Council has approved a resolution to replace the arc lamps now in use with 600-cp. incandescent lamps in the district from Locust to State Street and Court to Front Street. It is planned eventually to replace all the arc lamps in the city with incandescent lamps.

HAUTO, PA.—The Pennsylvania Power & Light Company will install a 20,000-kw. generating unit and auxiliary equipment in its local plant.

JUNIATA, PA.—Plans are being prepared by W. H. Cookman, architect, Broad Street Station, Philadelphia, for the erection of a local shop for the Pennsylvania Railroad Company, to cost about $300,000.

KINZUA, PA.—The Kinzua Light & Power Company is planning to build a new power plant in Kinzua.

PHILADELPHIA, PA.—F. W. Woodcock, F. B. Stem and associates have organized the following electric companies: The Dub-

lin Township, Beale Township, Clay Township, Tuscarora Township, Cromwell Township, Tell Township, Tod Township, Granville Township, Springfield Township, Milford Township and Lack Township Power companies. Power plants and transmission line will be installed in the respective districts. Application for state charters will be made on Nov. 20. The companies are represented by James C. Jones, Bullitt Building.

PITTSBURGH, PA.—Plans for the proposed new baking plant of the Ward Baking Company, 3,100 Liberty Avenue, to cost about $1,500,000, will include a power house.

TREICHLER, PA. — The Pennsylvania Power & Light Company is planning to install a local distributing system.

ANNAPOLIS, MD.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 1 for deferrization plant and a high-power radio station.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company will build a substation on West Pratt Street, to cost $22,000.

WILLIAMSPORT, MD. — The Potomac Public Service Company is planning to double the capacity of its proposed local generating plant. The cost is estimated at about $5,000,000.

FAIRMONT, W. VA.—The Consolidated Coal Company is planning to build a power house at Coalwood, to cost about $90,000.

RIDGEWAY, W. VA.—The installation of a municipal electric system is under consideration.

GRAFTON, VA.—The Monongahela Power & Railway Company plans to erect a sectionalizing switching and substation in Grafton, to cost about $30,000. Feed lines will be erected from the power plant at Rivesville to Grafton in the near future.

LA CROSSE, VA.—The La Crosse Light & Power Company, recently organized, will operate a local power plant and construct a transmission line for service to a number of neighboring communities.

NORFOLK, VA.—The United States Engineer Office will soon take bids for the construction of two power houses at Fort Storey, Va.

PORTSMOUTH, VA.—The Virginia Railway & Power Company has petitioned the City Council for permission to install an underground conduit from its substation on Middle Street to the navy yard gate to connect with the Richmond high-tension transmission line.

RICHMOND, VA. — Extensive improvements are being made by the Merchants' Cold Storage & Ice Manufacturing Company, to cost about $250,000. The work will include remodeling building, installing "Unaflow" engines and compressors, new boiler plant, 120-ton ice manufacturing plant, electric elevators, motors, etc. Ophuls & Hill, Inc., 112 West Forty-second Street, New York City, are engineers.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts until Oct. 31 for 15,000 weatherproof sockets for the Portsmouth Navy Yard. (Schedule 251.)

North Central States

CARO, MICH.—The property of the Caro Light & Power Company has been purchased by the Consumers' Power Company, Jackson, which will supply electricity in the city from its plant on the Ausable River. Transmission lines will be erected from Zilwaukee in the spring.

HOLLAND, MICH.—Plans for the proposed four-story hospital to be erected by the Holland Hospital Association, to cost about $275,000, will include a power house. Robinson & Campau, 715 Michigan Trust Building, Grand Rapids, are architects.

JACKSON, MICH. — The Consumers' Power Company has issued $14,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

JACKSON, MICH.—Work has started on the construction of the power plant at the Horton Street plant of the Hayes Wheel Company. The equipment will include two 750-kw. General Electric steam turbines and three boilers.

KALAMAZOO, MICH.—Work will begin at once by the Bryan Paper Company on the construction of a new central power plant, installation of a central machine shop and supply department, including a salvage plant for reclaiming and repairing supplies, to cost about $1,500,000.

NORTH MUSKEGON, MICH.—Bids have been rejected for the installation of an electrically operated pumping plant at the municipal waterworks, and new bids will be called at an early date. Hoad, Decker, Shoecroft & Drury, 303 South Street, Ann Arbor, are engineers.

ST. JOHNS, MICH. — Plans are under way for a power plant at the municipal waterworks, to cost about $150,000, including equipment.

CHILLICOTHE, OHIO.—Bids will be received by the Quartermaster General, 2,306 Munitions Building, Washington, D. C., until Nov. 14 for the installation of a lighting system in the proposed new hospital at Camp Sherman, Chillicothe, comprising twenty-two buildings.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Nov. 3 for paper-insulated lead-covered wire for the division of light and power.

CLEVELAND, OHIO.—The City Council is considering building a reservoir, administration building, power plant, chemical, gate and pressure houses at the Baldwin site, to cost about $4,500,000. A. V. Ruggles, City Hall, is engineer.

CLEVELAND, OHIO.—The installation of an ornamental lighting system on Superior, Rough, Wade Park, St. Clair and Euclid Avenue is under consideration by the City Council. The cost is estimated at $150,000.

WOODSFIELD, OHIO. — Contract has been awarded by the Council for a new power station for the municipal light plant.

HICKMANN, KY.—The Kentucky Light & Power Company will build a transmission line, about 20 miles long, with distributing lines at a number of towns along the route for light and power service.

JACKSON, KY.—The Kentucky Utilities Company is taking bids for a one-story and basement power plant, 40 ft. x 55 ft.

LOUISA, KY.—The installation of an electric lighting system is under consideration by the Council.

AUBURN, IND.—Bids will be received by G. Potter, city clerk, until Nov. 2 for furnishing and installing machinery and general equipment for the municipal electric light, power and water plant.

TERRE HAUTE, IND.—Plans are being prepared by the Vigo Mining Company, Rose Dispensary Building, for the erection of a power house, to cost about $75,000. The Shourds-Stoner Company, Tribune Building, is architect.

VINCENNES, IND.—The Blackford Window Glass Company contemplates the construction of a power plant in connection with its proposed glass works, to cost about $300,000.

MARSHALL, ILL.—Bids will be received by the Mayor and City Council until Nov. 9 for new power house, two alternating-current generators directly connected to "Unaflow" engines, switchboard, two boilers, piping, chimney, moving and resetting one fire-tube boiler, etc.; furnishing and installing ice-making machinery (15 tons daily capacity), distilled-water ice plant and erecting ice-plant building complete, etc. F. L. Wilcox, Chemical Building, St. Louis, is engineer.

CHILTON, WIS.—The Calumet Service Company is planning to extend its transmission lines to furnish electricity in Calumet Harbor, Charlesburg and Stockbridge. The cost is estimated at $25,000.

BAYARD, IOWA.—At an election held recently the proposal to sell the municipal electric light plant to the Iowa Railway & Light Company, Cedar Rapids, was carried. A franchise was also granted.

GILMORE, IOWA.—C. W. Lamphere will install electrical equipment at his proposed ice-manufacturing plants to be located at Eagle Grove and Clarion, to cost about $75,000.

KNOXVILLE, IOWA.—Bids will be received by the city of Knoxville until Nov. 10 for furnishing and installing complete an ornamental street-lighting system on certain streets of the city. Plans and specifications are on file in the office of the city clerk and in the office of Frank D. Paine, engineer, Station A, Ames, Iowa.

SPENCER, IOWA.—Plans are being prepared for an addition to the municipal electric plant, to cost about $30,000. W. C. Barton, 1221 Forty-third Street, Des Moines, is architect.

CARROLLTON, MO.—Improvements will be made to the local power plant of the Sinclair Oil Corporation, to include the installation of a new engine and auxiliary equipment.

MOBERLY, MO.—The Council is considering the installation of an ornamental lighting system, to cost about $7,000.

ST. LOUIS, MO.—Bids, it is understood, will soon be asked by the Department of Public Works for the construction of a power, ice and refrigerating plant at the training school at Scott Farm. W. E. Bowen, City Hall, is engineer.

ST. LOUIS, MO.—Plans are being prepared by the Atlas Tack Company, Fairhaven, Mass., for the construction of branch factory at Union and Geraldine Avenues, to cost, including equipment, about $500,000. The Widmer Engineering Company, Laclede Gas Building, St. Louis, is engineer.

ST. LOUIS, MO.—The United Railways Company will build a power house at Eighth Street and Franklin Avenue. An electric substation will also be erected in this district.

ST. LOUIS, MO. — The Wood & Lane Company, 915 Olive Street, contemplates the purchase of an engine-generator set of not more than 500 kw. capacity and a 150-kw. motor-generator set.

SPRINGFIELD, MO. — The Mountain Grove Creamery, Ice & Electric Company plans to rebuild its power plant, recently destroyed by fire, causing a loss of about $100,000.

VANDALIA, MO.—The Missouri Utilities Company is planning to rebuild its local substation, recently destroyed by fire, causing a loss of about $7,000.

GRAND ISLAND, NEB. — The Central Power Company plans to build a 5,000-kw. steam-driven electric plant in Grand Island, to cost about $750,000. A transmission line will be built.

CENTERVILLE, KAN.—The Sinclair Oil & Gas Company, Tulsa, Okla., will build an addition to its local electrically operated pumping plant. Additions will also be made to the plants at Humboldt, Johnesburg and Sycamore, Kan.

EUREKA, KAN.—The Eastern Kansas Power Company has issued $150,000 in bonds, part of the proceeds to be used for extensions and improvements.

Southern States

GREENVILLE, S. C.—The addition to be erected at the textile plant of the Judson Mills, Inc., to cost about $500,000, will be equipped throughout with electrically-driven machinery.

MOORESBORO, N. C.—The Sandy Run Electric Company, recently incorporated, has been granted franchises to supply electricity in the towns of Mooresboro, Lattimore, Boiling Springs and Ellenboro. The company will purchase electricity from the Southern Power Company, which has agreed to erect a transmission line and a substation at Lattimore or Mooresboro. The company is capitalized at $25,000.

RIDGEWAY, S. C. — Plans have been authorized for a municipal electric light plant and waterworks. The Ryan Engineering Company, Columbia, is engineer.

MORRISTOWN, TENN. — The Taylor Manufacturing Company will install electrical equipment at its woodworking plant, including motors, controllers, etc.

BIRMINGHAM, ALA.—The Public Service Commission has granted the Alabama Power Company permission to erect a new transmission line from Leeds to Lewisburg. The company was also given authority to sell 10,000 shares of capital stock at not less than 95.

FOLEY, ALA.—The Foley Light & Power Company will install a local power plant for commercial service throughout this district.

MOSS POINT, MISS. — The Southern Paper Company contemplates building an addition to its power house in connection with general mill expansion.

UTICA, MISS.—Bids will be received by the Mayor and Board of Aldermen until Nov. 9 as follows: One oil engine directly connected to alternator, one belted alternator, switchboard, pumps, pole-line material, 12,000-gal. oil-storage tank, repairs to building, etc. Swanson-McGraw, Inc., United Fruit Building, New Orleans, are engineers.

PIGGOT, ARK.—The installation of a municipal electric light and power plant is under consideration.

NEW ORLEANS, LA.—The New Orleans Railway & Light Company is preparing plans for an addition to its generating plant. Two electric substations will also be built and extensions made in the transmission system. The cost is estimated at $150,000. Dwight P. Robinson & Company, 125 East Forty-sixth Street, New York, are engineers.

NEW ORLEANS, LA.—The Lukins Steel Company, Coatesville, Pa., will build a power house in connection with its proposed local plant, to cost about $300,000.

SHREVEPORT, LA.—The Southwestern Gas & Electric Company has issued $2,500,000 in bonds, part of the proceeds to be used for extensions and improvements.

EMPIRE CITY, OKLA.—The Wichita Pipe Line Company, Walters, contemplates erecting a power plant in Empire City and an electrically operated pumping plant in the vicinity of Beaver Creek in connection with a new oil pipe line.

ENID, OKLA.—Contract has been let to R. G. Clark for the erection of a transmission line to Hillsdale, Kremlin, Goltry and Nashville, about 45 miles, at $24,000.

AMARILLO, TEX.—The installation of a municipal fire-alarm system, to cost about $30,000, is under consideration.

DALLAS, TEX.—The Dallas Power & Light Company has purchased a site on which it will erect the proposed extension to its present plant at a cost of about $2,180,000.

EL PASO, TEX.—The lighting committee contemplates the installation of a lighting system on a number of streets.

FARWELL, TEX.—A contract has been made for power service from the municipal plant at Clovis, N. M., for local distribution.

Pacific and Mountain States

CHELAN, WASH.—The Great Northern Railway Company is planning to build an ice-manufacturing and cold-storage plant here, to cost, including machinery, about $450,000.

SEATTLE, WASH.—The Puget Sound Power & Light Company has issued $1,300,000 in capital stock, part of the proceeds to be used for extensions and improvements.

PORTLAND, ORE.—The Federal Power Commission has granted the Pacific Power & Light Company a permit to develop a power site on the Columbia River. The proposed plant will develop about 54,000 hp.

LOS ANGELES, CAL.—Prescott T. Stevens, 7353 Sunset Boulevard, and associates have petitioned the Water Supply Commission for permission to build a 450-hp. power plant on the White Water River, Riverside County, to cost about $75,000.

SAN DIEGO, CAL.—Edward Fletcher, 9 Twenty-eighth Street, and associates have received permission from the State Water Commission to construct a 3,000-hp. hydroelectric plant on Santa Ysabel and Black Canyon Creeks, to cost about $350,000.

SAN FRANCISCO, CAL.—J. W. Preston, Jr., 350 Post Street, and associates have applied to the Water Supply Commission for permission to construct hydro-electric power plants on the North Fork of the Makelumne River and Sutter Creek, to develop 35,000 hp. and 31,000 hp. respectively.

TURLOCK, CAL.—The Board of County Supervisors have granted the Turlock Irrigation District a franchise to erect transmission lines within the district.

WILMINGTON, CAL.—The Shell Oil Company of California, San Francisco, contemplates the construction of a power house in connection with its proposed oil refinery at Wilmington, to cost about $1,000,000.

BOISE, IDAHO.—Bids will be received by the United States Reclamation Service, Denver, Col., until Dec. 6 for two pumping units for the Black Canyon pumping plant, Boise, project.

BOISE, IDAHO.—The Idaho Power Company has petitioned the Federal Power Commission for a license to erect a 44,000-volt transmission line from American Falls to Pocatello. This line will connect the company's system with that of the Utah Power & Light Company.

PUEBLO, COL.—Application has been made to the Federal Power Commission by Anna P. Gray, Pueblo, for a preliminary permit covering three small power projects at the headwaters of South Colony Creek in Custer, which it is estimated will develop about 1,800 hp., to be used for mining purposes.

Canada

YARMOUTH, N. S.—A proposed hydroelectric project on the east branch of Bear River, which would supply electricity on the north shore of Nova Scotia from Yarmouth to Middletown, was outlined in an address to the Town Council by K. H. Smith, chief engineer of the Nova Scotia Water Power Commission.

CAMPBELLFORD, ONT.—The Hydro-Electric Power Commission of Ontario contemplates building a new power house at Lock No. 8.

WESTON, ONT.—Imrovements are contemplated to the municipal electric light and power plant, to cost about $25,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 3, 1922)

1,431,047. METHOD OF AND APPARATUS FOR PROMOTING CHEMICAL REACTIONS BETWEEN GASES; S. Ruben, New York, N. Y. App. filed April 16, 1920. By passing high frequency current through liquid.

1,431,063. X-RAY CATHODE; S. Tousey, New York, N. Y. App. filed Aug. 25, 1920. Cathode used of such form that relatively weak current may be employed.

1,431,091. SIGNALING SYSTEM; W. H. Bendernagel, Brooklyn, N. Y. App. filed Oct. 23, 1918. Signaling means provided at intermediate station on a telephone line.

1,431,116. SEMI-AUTOMATIC TELEPHONE SYSTEM; C. A. W. Hultman, Stockholm, Sweden. App. filed Dec. 23, 1918. Simplified switch operation in the group-switching stages.

1,431,135. OVERLOAD APPARATUS FOR ALTERNATING-CURRENT MOTORS; H. C. Stratton, Cleveland, Ohio. App. filed May 19, 1919. Thermal overload relay.

(Issued Oct. 10, 1922)

15,466 (reissue). METHOD OF ELECTRIC WELDING; T. E. Murray, Jr., Brooklyn, N. Y. App. filed Jan. 16, 1922. Welding current from 50,000 amp. to 100,000 amp. per square inch.

1,431,158. INCANDESCENT ELECTRIC LAMP; J. A. Heany, New Haven, Conn. App. filed Nov. 27, 1918. Means of joining lead-in wire and filament.

1,431,184. ELECTRIC HEATING DEVICE; J. R. Rose, Edgeworth, Pa. App. filed March 8, 1920. Reflector type.

1,431,195. TELEPHONE EXCHANGE SYSTEM; J. F. Toomey, New York, N. Y. App. filed May 26, 1921. Arrangement for signaling called subscriber.

1,431,196. THERMO-TELEPHONE TRANSMITTER AND RECEIVER; R. A. Baron Van Lynden, Utrecht, Netherlands. App. filed March 12, 1918. Provided with hot wire having insulating coating in contact with air.

1,431,202. ELECTRIC ARC LAMP; W. Wenderhold, New York, N. Y. App. filed Jan. 14, 1918. Carbon supports pivotally mounted for independent movement about common axis.

1,431,219. ELECTRON TUBE REPEATER; G. Crisson, Hoboken, N. J. App. filed May 20, 1919. Apparatus and circuits for preventing cross-talk through filament circuits.

1,431,231. RESISTANCE UNIT; J. G. Homan, Steubenville, Ohio. App. filed Nov. 1, 1921. Composed of laminated structure formed of sheet metal having an oxide coating thereon.

1,431,245. METHOD OF AND APPARATUS FOR PURIFYING LIQUIDS; F. W. Mitchell and J. E. Pfeffer, Chicago, Ill. App. filed Aug. 2, 1918. Electric current used to kill bacteria in milk.

1,431,249. MOTOR CONTROLLER; F. H. Oberschmidt, Cleveland, Ohio. App. filed Nov. 6, 1920. Automatic regulation for acceleration and dynamic braking of rubber calenders.

1,431,254. REGULATING SYSTEM; F. L. Re Qua, Milwaukee, Wis. App. filed April 7, 1919. Apparatus for regulating generator voltage.

1,431,261. ELECTRIC IGNITION APPARATUS; L. W. Rosenthal, New York, N. Y., and G. J. Lang, Weehawken, N. J. App. filed Oct. 1, 1918. Simultaneously produces sparks at two or more spark plugs from two or more magnetos.

1,431,271. RADIO-SENSITIVE ELEMENT; H. W. Van Allen, Springfield, Mass. App. filed April 12, 1921. Films of X-ray machine arranged to avoid any distortion of image.

1,431,295. CURRENT COLLECTOR; G. B. Evans, St. Louis, Mo. App. filed June 4, 1921. Collector rings for machines of rolled brass.

1,431,301. PROCESS OF EXTENDING THE CATALYTIC ACTIVITY OF MERCURY COMPOUNDS; N. Grunstein, Frankfort-on-the-Main, and P. Berge, Griesheim-on-the-Main, Germany. App. filed May 21, 1919. Treating acid-reaction liquid containing mercury salts with electric current.

1,431,308. CIRCUIT CONTROLLER; B. W. Jones, Schenectady, N. Y. App. filed Nov. 26, 1921. Electro-responsive line switches.

1,431,325. ELECTRIC FIXTURE; J. F. Pedersen, Racine, Wis. App. filed Aug. 23, 1920. Swiveled connection between the two parts of fixture prevents tangling of wire.

1,431,340. TROLLEY WIRE SPLICE RUNNER; W. W. Terry, Portsmouth, Va. App. filed May 25, 1922. Protective runner clamps wires to be connected and extends beyond splice.

1,431,349. ADJUSTABLE SPEED-STARTING DEVICE FOR ELECTRIC MOTORS AND THE LIKE; G. O. Wilms, Milwaukee, Wis. App. filed May 12, 1920. By compression of resistance medium.

1,431,393. HIGH-FREQUENCY OSCILLATOR; A. L. Golden, Oakland, Cal. App. filed May 16, 1917. Employs electrodes which permit gases formed to discharge freely. Used with telephone or telegraph.

1,431,407. ELECTRIC HEATING UNIT; L. R. McClatchie, Penetanguishene, Ontario, Can. App. filed Aug. 1, 1921. Enlarged coils arranged at intervals support coils clear of grooved walls in grill plate.

1,431,418. ELECTRIC HEATING APPARATUS; E. Phillipson, New York, N. Y. App. filed May 31, 1921. Reflector type emits heat both horizontally and vertically.

1,431,424. ELECTRIC FURNACE; I. Rennerfelt, Djursholm, Sweden. App. filed Aug. 10, 1921. Rotating hearth on which articles are placed surrounds heating element formed of electrodes.

1,431,468. ELECTRICALLY HEATED DEVICE; J. F. Lamb, New Britain, Conn. App. filed Aug. 11, 1919. Plate type.

1,431,545. MAGNETIC DISTORTION MOTOR; M. A. Schwartz, Los Angeles, Cal. App. filed July 2, 1920. Temperature-varying magnetic elements, field magnets and heating jets placed around and below armature.

1,431,574. ELECTROLYTIC APPARATUS; H. Y. Eagle, Brooklyn, N. Y. App. filed Nov. 12, 1920. Groups of electrodes, each group receiving current from a different conductor.

1,431,578. X-RAY SYSTEM; H. D. Garretson, New York, N. Y. App. filed Feb. 5, 1921. No high-potential wires exposed.

1,431,580. ELECTRIC WATER HEATER; O. Graetzer, Zollikon and O. F. Bruman, Zurichenge, Switzerland. App. filed Aug. 31, 1921. Water-heating faucets in which liquid acts as resistance element.

1,431,597. AUTOMATIC WORK-RECORDING APPARATUS; W. Poppelreuter, Bonn, Germany. App. filed Nov. 20, 1919. Records work executed by men or man-operated machine.

1,431,602. ART OF ELECTROLYSIS; C. G. Spencer, New York, N. Y. App. filed Jan. 15, 1921. Electrolytic generation of oxygen and hydrogen from water.

1,431,620. ELECTRIC MOTOR; E. C. Ballman, St. Louis, Mo. App. filed Sept. 4, 1917. Stator end frames so constructed as to secure rigidity and uniform air gap.

1,431,622. ELECTRICAL CONNECTOR DEVICE; R. B. Benjamin, Chicago, Ill. App. filed Dec. 12, 1919. Plug sockets for low-voltage lighting circuits.

1,431,627. REMOTE-CONTROL SYSTEM; W. H. Bristol, Waterbury, and M. J. Johnson, Naugatuck, Conn. App. filed March 18, 1919. Single-phase synchronized remote-control recorder.

1,431,638. ELECTRICAL MEANS FOR DETECTING, OBSERVING, INDICATING, MEASURING OR UTILIZING MINUTE MOVEMENTS; J. J. Dowling, Rathgar, Ireland. App. filed May 17, 1921. Utilizes vacuum tube to discern very small differences in measurements.

1,431,666. SYNCHRONIZED APPARATUS; M. J. Johnson, Naugatuck, Conn. App. filed July 31, 1920. Provides for direct driving of phonograph or similar apparatus from corresponding rotor member of synchronized unit.

1,431,670. PARLOR FLOOR LAMP; J. Klein, Cleveland, Ohio. App. filed Aug. 24, 1921. Pedestal lamp with floor lamp inclosed in base.

1,431,678. CIRCUIT BREAKER; B. M. Mooers, San Francisco, and L. E. Warner, Berkeley, Calif. App. filed Dec. 27, 1917. Disconnects apparatus when temperature becomes destructive and holds breaker opened until danger is passed.

1,431,686. INDUCTION FURNACE; W. Rohn, Hanau, Germany. App. filed Dec. 21, 1920. Annular melting channel surrounded on all sides by the primary coil and both channel and primary coil surrounded by iron.